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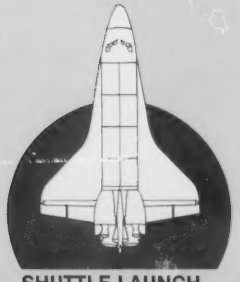

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INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes passenger and cargo air transport operations; and aircraft accidents.

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Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1147

Includes aircraft simulation technology.

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06 AIRCRAFT INSTRUMENTATION 1150

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1150

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1151

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1151

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For related information see also *14 Ground Support Systems and Facilities (Space)*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

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Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1155

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19 SPACECRAFT INSTRUMENTATION N.A.
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20 SPACECRAFT PROPULSION AND POWER 1155
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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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24 COMPOSITE MATERIALS 1157
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26 METALLIC MATERIALS 1167
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28 PROPELLANTS AND FUELS 1175
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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

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77 THERMODYNAMICS AND STATISTICAL PHYSICS 1274
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1275
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1275
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 1277
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1278
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1282
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1282
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1283
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1283
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1284
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1285

Note: N.A. means that no abstracts were assigned to this category for this issue.

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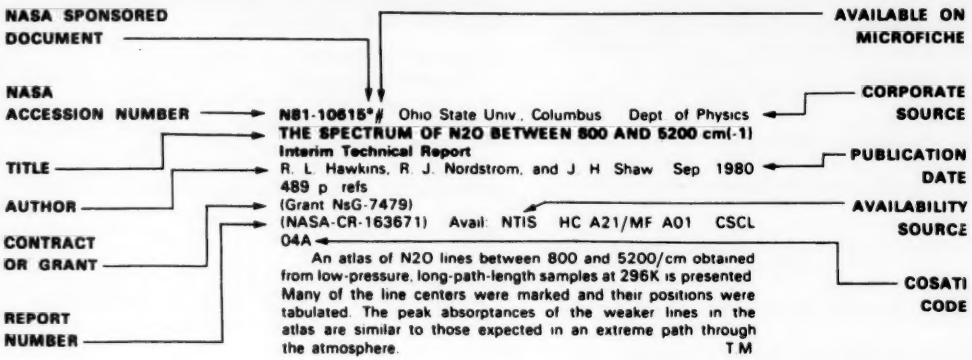
TYPICAL CITATION AND ABSTRACT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N81-10615*# Ohio State Univ., Columbus Dept. of Physics
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THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
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R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep 1980
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere. T.M.
REPORT NUMBER

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, TURBINE ENGINE LOW ASPECT RATIO TECHNOLOGY

P.R. Dodge, Garrett Corp., *402 S. 36th St., Phoenix, Arizona* 85034 (DF456730; F33615-74-C-2017)

This program extends the successful technology of AF contract F33615-68-C-1208 to low aspect ratio turbine blade problems, especially for high temperature cooled blades.

A time phased effort to identify the loss mechanisms of low aspect ratio cooled turbines will be pursued. Cold stationary and rotating rigs will be used to verify loss mechanisms and evaluate methods to reduce these losses. The approach to this improvement is expected to extend the work of F33615-68-1208.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0002, IMPROVED SURGE MARGIN CENTRIFUGAL COMPRESSOR

R. Clarke, Signal Co. Inc., Airesearch Manufacturing Co, *402 S. 36th St., Phoenix, Arizona* 85034 (DA0D3999; DAAJ02-75-C-0033)

The objective is to investigate experimentally the factors critical to centrifugal compressor flow range, surge, and efficiency flow characteristics, and subsequently, to demonstrate a single-stage, high-pressure-ration centrifugal compressor having peak performance on or near a projected engine operating line. Achievement will result in approximately a four point improvement over current operating line efficiency with a predicted 6-8 percent reduction in fuel consumption and its attendant potential for increased range and/or payload for future Army helicopters.

Design a baseline 10-1 pressure ratio compressor having a geometry favorable to broad flow range and a number of modifications thereof varying geometrical/aero factors critical to flow range and efficiency. Fabricate, test and analyze data to formulate design correlations for the critical factors. Use the correlations to design, fabricate and test an optimum compressor stage.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0003, ACOUSTIC FREQUENCY - TIME DECOMPOSITION INVESTIGATION OF HELICOPTER NOISE

S.A. Fidell, Bolt Beranek & Newman Inc., *21120 Vanowen St., Canoga Park, California* 91303 (DA0G2255; DAAK51-80-C-0008)

Investigate the aural frequency versus time duration effects of helicopter type noise on human observers and incorporate substantive findings in an existing helicopter detection computer program.

A review of research efforts pertaining to effects of signal duration on audibility will be performed. This will be followed by development of a psychoacoustic test rationals and design of the actual testing to be employed. Emphasis will be on determining critical bandwidths of human observers at the frequencies and time duration of interert. Results of the tests will be analyzed and any appropriate changes will be incorporated in the Applied Technology Laboratory's helicopter detection computer program.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0004, VISCOELASTIC BEHAVIOR OF THE INTERVERTEBRAL DISC RELATED TO EJECTION SHOCK

W.G. Knauss, California Inst. of Technology, Graduate School, Dept. of Aeronautics, *1201 E. California Blvd., Pasadena, California* 91109 (DF046780; AFOSR-77-3139)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including flail and impact. The body in general and the musculoskeletal system particularly is adversely affected by these forces. This is of special importance in cases of ejection from high performance aircraft where the probability of disabling injury is unacceptably high. Deficiency - non-invasive techniques that may provide information about the mechanical performance of the human intervertebral disc do not exist. This information is important for the diagnosis as well as for the prevention of low back injuries, as may occur in aircraft ejections. This research seeks to set up the basis for the development of such a technique. Objective - the overall objective of this research is to improve the knowledge of the physiology and mechanical properties of the human intervertebral disc. How research contributes - this work should provide essential information to understand the short duration, transient loading problems of the spinal discs and contributes directly to subarea 1.8, 'Aircrew Safety and Effectiveness in Mechanical Force Environments' and will also be applicable to the fields of diagnostic, preventive and reparative medicine.

This final phase of the study will investigate the relaxation behavior of compressed spinal discs as a function of flux of water content under strain spinal section segments will be subject to stress relaxation for various time durations and subsequent measurement of change of water content. Testing will then proceed based upon the influence of fiber orientation on relaxation behavior. In addition to observations of mechanical characterization, it is planned to examine whether visco-elastic lamination theory for fiber-composite solids applies to the composite disc material of the annulus fibrosis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0005, SMART WEAPON-AIRFRAME DESIGN INTERFACE

H. Gordon, Developmental Sciences Inc., *15747 E. Valley Blvd., P.O. Box 1264, City of Industry, California* 91749 (DA0G2756; DAAK51-80-C-0009)

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0006, SKY EYE R4D RPV AIRFRAME AND SPARE PARTS

G. Harris, Developmental Sciences Inc., *15747 E. Valley Blvd., P.O. Box 1264, City of Industry, California* 91749 (DA0G0815; DAAK51-80-C-0004)

An earlier program has experienced a crash and the major airframe parts must be replaced.

Using existing patterns and molds build airframe parts and repair on-board equipment.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0007, COMBAT MAINTENANCE CONCEPTS AND REPAIR TECHNIQUES (STRUCTURES)

T.N. Cook, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0G0421; DAAK51-79-C-0049)

To develop inspection and field repair concepts for combat damage to Army helicopters' structures.

Using the UH-60A Black Hawk, this program will explore the problems associated with the repair of combat-damaged helicopters in the field. Four of the known threats facing helicopters on the modern battlefield will be evaluated. Representative airframe damage will be simulated, structurally analyzed and classified with respect to repairability and deferrability. Generalized criteria for deferring combat damage will be developed, and candidate inspection procedures will be defined. Concepts for interim repair of nondeferrable damage will be developed, evaluated and ranked. Based on the results of this work a total combat maintenance support concept for Army helicopter airframes will be recommended.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0008, SOLID STATE RADIO MAGNETIC/HORIZONTAL SITUATION INDICATOR (RMI/HSI)

B. Hoffman, Hughes Aircraft Co., Aerospace Groups, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0D3523; DAAB07-77-C-2194)

The objective of this task is the development of a digitally addressable, programmable, solid state RMI/HSI employing a flat panel display. This unit is intended to replace existing electro-mechanical devices and be compatible with new, in-development, digital sensors, processors and the MIL-STD-1553A(B) Digital Data BUS.

Integrate a flat panel (solid-state) display, drive circuitry, programmable symbol generator, signal processor, and control unit to accept and display all appropriate RMI/HSI signals for demonstration and evaluation of feasibility for eventual incorporation in Army aircraft.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0009, METHODS/DEVICES TO IMPROVE HELICOPTER AUTOROTATION CHARACTERISTICS

A.H. Logan, Hughes Aircraft Co., *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0G2747; DAAK51-80-C-0011)

To conduct a prliminary design study of active and passive methods and devices to improve conventional power-off and one-engine-inoperative autorotation capabilities; and to formulate autorotation performance design criteria.

Assemble a compendium of candidate rotorcraft autorotation assist concepts; conduct a qualitative evaluation of selected concepts for a broad matrix of helicopter configuration variables; conduct preliminary design studies of concepts for single-engine, utility, attack and scout-type helicopters and a new generation twin-engine helicopter; conduct a detailed design and analytical evaluation of an auxiliary energy concept for a scout-type helicopter; develop autorotation design criteria to take advantage of autorotation assist concepts.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0010, RESEARCH OF TUTORIAL CAPABILITY FOR THE USE OF LARGE STRUCTURAL ANALYSIS SYSTEMS

R.J. Melosh, Marc Analysis Research Corp., *260 Sheridan Ave., Suite 314, Palo Alto, California* 94306 (DF133220; F33615-78-C-3206)

The use of finite element analysis for the design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. The effective use of large structural analysis systems requires the user to devote a considerable effort and long calendar time to become familiar with its capabilities or consult some person who is an expert in its utilization. The objective of this effort is to explore the possibility of creating an expert consultant by utilizing the capabilities of a computer. The successful accomplishment of this objective will insure the ready capability to provide the analysis support for present and future aerospace systems, such as F-16, A-10, and YC-15 with a minimum analysis time.

A literature search has revealed that significant advances have been made in other scientific fields in using the methodology of production systems to create an expert consultant. The ideas of production systems will be utilized to investigate the possibility of creating an expert consultant for the use of large structural analysis systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, DEVELOPMENT OF AN AIRCRAFT FUEL CONSUMPTION SIMULATION MODEL

D.E. Winer, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (08995-00999; DOT-FA79WA-4391)

The objective of this program was to develop an aircraft fuel burn simulation model to facilitate the energy impact analysis of: (1) proposed changes to operating procedures; (2) airport delay effects; and (3) other regulatory changes. The model will be made available to the public, providing a uniform and accurate methodology for assessing fuel consumption characteristics of complex flight patterns enroute and in terminal areas around airports.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0012, ENVIRONMENTAL EFFECTS AND DURABILITY EVALUATION OF ADVANCED COMPOSITE STRUCTURE

H.T. Lund, Summa Corp., Hughes Helicopters Division, *Centinela Ave. & Teale St., Culver City, California* 90230 (DA0E3836; DAAK51 78 C 0004)

The objective of this work is to develop and fabricate full-scale flight worthy OH-58 tail sections (tailboom, horizontal stablizer, vertical fin) and fly them on service helicopters in place of existing metallic components. The composite tail sections will be flown and maintained under actual service conditions to evaluate the long-term effects of exposure to the natural elements (i.e. heat, cold, moisture, ultraviolet, etc.), coupled with daily service usage.

The initial work will be the development of preliminary design concepts to improve structural performance and reduce fabrication cost. In addition to improved structural designs, the composite tail section will include reasonable design modifications and innovations to enhance ballistic survivability when impacted with 23mm HEI and reduced radar detection. Selection: Selected tail section design will be fabricated and tested (both laboratory and flight demonstration) prior to quantity fabrication of tail sections and subsequent service installation and environmental/durability evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0013, RESEARCH IN AERODYNAMICS

I.C. Statler, U.S. National Aeronautics & Space Admin., Ames Research Center, *Moffett Field, California* 94035 (DA0C5001)

To expand the technologies in those areas which are most likely to impact improved operational and cost effectiveness,

survivability and safety of future Army airmobile systems. Analytical and experimental studies are selected on the basis of a continual review of the Army's aviation objectives and assessment of those fundamental technological deficiencies which would prevent achievement of the desired objectives.

Rotary-wing research will be conducted through joint participation with NASA to develop or improve analytical tools, prediction techniques, and fundamental understanding related to basic fluid mechanics, rotary-wing airfoils, acoustics, rotary wing dynamics and control, and flight simulation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0014, HELICOPTER MAN-SYSTEM INTEGRATION
Unknown, U.S. National Aeronautics & Space Admin., Ames Research Center, *Moffett Field, California* 94035 (505-42-41)

The objectives of this program are: (1) to develop advanced information display, data entry and pilot interface techniques for helicopter IFR operations, low visibility landing, industrial mission performance and obstacle avoidance, (2) to develop pilot workload and stress assessment techniques to allow comparison of advanced helicopter control system navigation and guidance systems, and (3) to determine information requirements, pilot performance limits, and operational procedures associated with improved helicopter flight operations. Research activities will be continued to develop a helicopter oriented human factors data base concerning a variety of advanced pilot/display/control interface techniques, including automatic speech recognition, speech synthesis, and visual/auditory and tactile displays. Research will also be initiated to develop a methodology for helicopter workload certification, including an analysis of automated task techniques, simulator measures, and flight verification procedures. These activities will be performed in cooperation with work being conducted at Ames by the Army Aeromechanics Laboratory. Later in the program, contracts, and in-house efforts will be developed to study problems associated with improved helicopter operations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0015, COMMUTER TRANSPORT AIRCRAFT TECHNOLOGY
Unknown, U.S. National Aeronautics & Space Admin., Ames Research Center, *Moffett Field, California* 94035 (530-04-11)

The objective of this work is to develop a sound advanced technology base for use in the design and development of future short to medium range commercial transport aircraft. This objective will be achieved by advancing aircraft technology having the potential for cost effective application. Activities will include aircraft design studies, analytical research, and experimental research investigations. The emphasis will be on developing the appropriate technology for application to small transport aircraft designed for commuter and local service airline usage. A project entitled 'Small Transport Aircraft Technology' (STAT) was established in FY-78 and is planned to continue at least through FY-85. The project involves coordinated research conducted in several divisions within the Aeronautics and Flight Systems Directorate at the Ames Research Center and in the Aeronautics Directorate at the Lewis Research Center. The research conducted under the STAT project encompasses the aeronautical technology disciplines of systems integration, aerodynamics including flight dynamics, propulsion, aircraft systems and structures. The technology developed will ensure safer, more economical, efficient, and environmentally acceptable future small transport aircraft.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0016, ROTORCRAFT AEROMECHANICS/SYSTEMS TECHNOLOGY
Unknown, U.S. National Aeronautics & Space Admin., Ames Research Center, *Moffett Field, California* 94035 (532-06-11)

Research conducted under this RTOP will advance rotorcraft aeromechanics system technology with an emphasis on improving basic design theory, rotor and rotor/airframe aerodynamics and aeroelastic characteristics and methodology; vibration prediction and control; noise prediction and control; advanced all-weather guidance, navigation, and control systems concepts; advanced crew station concepts; and advanced vehicle concepts. The research involves focused and coordinated programs requiring analysis, model and large scale wind tunnel testing, simulation, and flight testing. These programs encompass civil and military aspects of advanced rotorcraft concepts which will increase performance, efficiency, and productivity; reduce noise and vibration; and improve reliability.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0017, HIGH SPEED AIRCRAFT AERODYNAMICS AND AIRFRAME/PROPULSION INTEGRATION
Unknown, U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center, *P.O. Box 273, Edwards, California* 93523 (505-43-24)

The broad objectives of this RTOP are to provide a sound technology base for the application of new and innovative non-axisymmetrical nozzle designs to future aircraft and to continue the development of new methods and techniques for investigating fluid flows and for evaluating the performance of flight test vehicles.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0018, AIRCRAFT GROUND MOBILITY SYSTEM (AGMS) DESIGN AND FABRICATION
J.P. Forsyth, Vehicle Systems Development Corp., *1251 W. 9th St., Upland, California* 91786 (DA0G2482; DAAK51-80-C-0010)

To provide a ground support system to significantly increase the ability of fighter aircraft to traverse soft and/or rough terrain in order to mobilize aircraft from parking areas to, and from, usable runways in a combat threat.

Using the wheeled aircraft landing gear floation improvement technology developed under contract DAAJ02-77-C-0077.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0019, DESIGN ASSESSMENT OF ADV TECH, LIGHT WEIGHT, LOW-COST MISSION CONFIGURED GONDOLA MODULES
J. Porterfield, Kaman Aerospace Corp., *Old Windsor Rd., Bloomfield, Connecticut* 06002 (DA0E3839; DAAK51 78 C 0012)

To perform design trade-off analyses in conjunction with the assessment of advanced technology materials (metallic and non-metallic composites) and effective structural arrangements and provide preliminary designs and critical item development specification (CIDS) for a lightweight, low cost system of gondolas.

Under prior R&D effort two experimental gondola systems were designed and fabricated. Operational suitability testing demonstrated the technical feasibility of the gondola concept and identified configuration and technological improvements essential to combat and combat service support missions. Current effort will perform design trade-off analyses for candidate advanced technology materials and structural arrangements and provide preliminary design and CIDS for a lightweight, low cost, efficient gondola system. Follow-up effort will consist of detailed design of technology demonstrator gondola modules, fabrication, static testing and flight evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0020, WIND TUNNEL INVESTIGATION OF MODEL HELICOPTER (ABBREV)
A.J. Landgrebe, United Technologies Corp., Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DA0F9013; DAAG29 77 C 0013)

To experimentally investigate helicopter rotor wakes for low forward speeds characteristic of current rocket firing tactics accounting for interference effects of the fuselage, wing, and the ground, and to utilize this data for determining analytically the velocity distributions along trajectories through the wake. Relevance: The research is directly relevant to the problem of a sight correction system on the AH-1G for the 2.75 in. rocket and to the problem of determining the correct position for a wind sensor. In addition, it is relevant to the determination of helicopter aerodynamic characteristics required in other investigations such as those associated with low speed, terrain flying missions.

Rotor wakes produced by a combined model rotor-fuselage-wing will be examined and measured by means of both laser velocimeter and visualization techniques for determining the wake velocities and geometries, respectively. The results of the experimental program will provide velocity and wake geometry data for correlation with theory and for a systematic determination of the effects of aircraft components, ground effect, and significant flight parameters.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0021, ACCIDENT INFORMATION RETRIEVAL SYSTEM (AIRS) INVESTIGATION

H. Ask, United Technologies Corp., Hamilton Standard Division, *Bradley Field Rd., Windsor Locks, Connecticut* 06096 (DA0E3843; DAAK51 78 C 0025)

Reduce Army aircraft accidents, enhance accident investigation validity and derive precise crashworthiness design criteria through the development and implementation of an accident information retrieval system that records flight and crash impact data.

AIRS detailed design, fabrication, component test, and system brassboard flight test in a Black Hawk helicopter-memory module will be subjected to impact and fire survivability tests.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0022, PACAM V INSTALLATION AND MODIFICATIONS

D.H. Schiller, A.T. Kearney & Co. Inc., *100 S. Wacker Dr., Chicago, Illinois* 60606 (DF144410; F33615-79-C-3027)

The Air Force function for this effort is to develop the methodology for assessing the potential air combat capabilities of advanced aircraft concepts. The problem is that current air combat simulation programs do not correlate with 'real world' data such as AIMVAL/ACEVAL. The objectives of this effort is to install PACAM V on the ASD CDC 6600 computer structured for the fast turn-around times necessary for parametric analyses and to modify this program to correlate with AIMVAL/ACEVAL. This would greatly increase the utility of pacam as an engineering design tool by increasing the confidence of selecting promising technologies and concepts for further study and/or technology planning.

This effort will build upon in-house analyses done under JON 24040131 which compared PACAM II with AIMVAL/ACEVAL and identified several deficiencies in the program. The latest generation, PACAM V, will be installed on the ASD CDC 6600, structured for INTERCOM compatibility, and checked out using the sets of runs from Kirtland AFB. runs conducted with PACAM II will then be conducted with PACAM V to identify the degree to which the deficiencies are still present. The program will then be modified to correspond with AIMVAL/ACEVAL data with check-out runs after each modification to ensure that it is functioning properly. Modifications will include tactical selection logic for vertical maneuvers, barrel roll, energy management, quick shot tactics, redefinitions of the offensive zone, and changes in cooperative tactics. The methodology used in JON 24040131 will also be used here.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, DEVELOPMENT OF A STOCHASTIC THEORY OF ROTOR BLADE DYNAMICS 15193-E

Y.K. Lin, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (DA0F9151; DAAG29-78-G-0039)

To develop a comprehensive stochastic theory of rotor blade dynamics capable of predicting instability in the presence of atmospheric turbulence. Relevance: Results from this research could be significant for the understanding and eventual design improvements of the Army helicopter rotors.

The standard equations of motion are generalized to include the effects of turbulence. Stability is defined in terms of stochastic convergence and the stochastic differential equations are solved using the method of Stratonovich. A limited experimental program will be carried out to provide data for comparison with the theoretical results.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

1.0024, NOE HELICOPTER NAVIGATION ANALYSIS

N. Shupe, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (DA0G2462; DAAK80-79-C-0268)

The objective of this program is the development of a terrain correlation navigational aid in the form of an extended Kalman filer algorithm which provides a continuous real-time update (accuracy improvement) of positional output from the AN/ASN-128 Doppler Navigation System. This enhancement of positional information is required as an essential component in an effectually integrated night navigation/pilotage system (NNPS) conforming to the stringent demands of low level nap-of-the-earth (NOE) flight.

This effort is comprised of 3 phases. Phase 1: identify performance characteristics of various equipments used in the Army's navigational suite. Develop models that represent error sources suitable for simulation studies. Phase 2: Parametric performance analysis of proposed algorithm with emphasis on sensitivity to key parameters such as various terrain data base configurations. Phase 3: Evaluate the selected filter algorithm focus on methods of improving heading accuracy and operational mission performance over typical NOE terrain. The final filter design should be capable of accepting all available navigational instrument outputs and be optimized for maximum improvement of position, velocity, and heading.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0025, EFFECTS OF WHOLE-BODY MOTION SIMULATION ON FLIGHT SKILL DEVELOPMENT

W.H. Levison, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF052530; F49620-78-C-0073)

AF function - this research contributes to knowledge about motion cues in flight simulation. Deficiency - the importance of motion in flight simulators used for training is not conclusive across a wide range of vehicle types and pilot experience level. This information impacts the simulator investment strategy and must be determined. Objective - this research is designed to provide operator control models for flight simulator motion configurations which will eventually predict learning behavior. How research contributes - these models will be useful in determining the motion cues which should be produced in a flight simulator to achieve an optimum learning outcome.

This work will be accomplished in conjunction with the Aerospace Medical Research Laboratory (AMRL/EMT), Wright-Patterson AFB, Ohio. An automated procedure will be developed for identifying pilot-related parameters for an optimal control model. Experiments examining task load, motion cue utilization, and attention sharing, in two-axis tracking tasks will be analyzed in terms of the model. Sensitive parameters will then be studied in transfer-of-training experiments to describe the utility of motion cues in learning for pilots of differential flight experience.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0026, OPTIMUM SINGULAR AERODYNAMICS AND THRUST MAGNITUDE MATCHING IN SUPERCRUISER FIGHTER

N.X. Vinh, Michigan State University, School of Engineering, Dept. of Aerospace Engineering, *Engineering Bldg., East Lansing, Michigan* 48824 (DF051710; AFOSR-78-3555)

AF function - design optimum flight profiles. Deficiency - the optimum flight profile for maximum range with a given fuel load changes with a minimum time constraint. Objective - the objective of this proposal is to investigate the optimum aerodynamics of a supercruiser and its matching with the singular thrust control to minimize the fuel consumption over a prescribed range under a certain time constraint. How work contributes - results in this study will aid in the design of a supercruiser fighter.

The theory for singular aerodynamics and thrust controls with time constraint will be developed. Quantitative analysis will be carried for the supercruiser concept and minimum fuel consumption to cover a prescribed range will be obtained as a function of the prescribed cruising time. It is expected that optimum Mach number will move to supersonic range. In a three-dimensional space representing the fuel weight, range, and time the reachable domain for the example aircraft can be plotted. The limitation in the range, as the time for cruising flight decreases, is then explicitly displayed. The reachable domain is obviously a function of engine performance, and aerodynamic characteristics. The remaining problem to be investigated is how to configure aerodynamically the aircraft in supersonic performance to extend the range without compromising its transonic maneuvering requirements in the combat arena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0027, MAC STABILITY AND CONTROL DATA DISCREPANCIES

R.W. Thomas, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF143610; F33615-79-C-3608)

This work unit supports TPO3, flight control, and major thrust, FGO2D3, aircraft stability and control prediction. Specifically, it addresses the problem area involving the differences observed between predicted and actual flight characteristics. The objective of this effort is to identify and resolve serious discrepancies observed during an aircraft development program between predicted stability and control values and those measured in-flight. This effort will investigate test and analysis methods used to predict stability and control characteristics which will result in a more accurate mathematical representation of predicted aircraft dynamics.

This program will analyze a discrepancy between predicted and flight test stability and control characteristics observed in the F-15 development program. This analysis will cover both the methods used in obtaining the predicted flight characteristics and the procedures involved in extracting aerodynamic data from flight test results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, MULTIPLE AIRCRAFT APPROACH LANDING TECHNIQUES

A. Brockway, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Avionics Research & Development Activity, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0C3435)

The primary objective of this task is to investigate V/STOL instrument approach requirements, controller techniques, terminal area flight procedures and landing/air traffic control (ATC) equipment requirements for realizing, especially under IMC conditions, high landing rates consistent with the intrinsic flight characteristics of the helicopter. This includes an examination of V/STOL related terminal area ATM problems (via computer simulation and subsequent flight experimentation) under conditions of both IMC and VFR. The ultimate goal is to establish cooperative pilot/controller techniques and landing/ATC equipment requirements, which will make possible efficient landing of IMC terminal area V/STOL traffic with minimum separation of aircraft.

Apply AVRADA's computer simulation (I/A SIM) facility to simulate an air traffic control (ATC) terminal area with closely spaced IMC helicopter traffic. The I/A SIM facility provides for interactive input from one simulated controller position and four simulated V/STOL pilot positions. Also, investigate cooperative pilot/ATC techniques, procedures and equipment requirements allowing pilot, in cooperation with controller, to set his own separations from other nearby aircraft. Apply the data and experience from these investigations to fabricate an experimental crossbanded military microwave landing system (MMLS)/ATC system to achieve a tactical landing and ATC capability in a minimum size equipment. This system would possess the resolution, accuracy and data rate of the MMLS and would utilize the airborne MMLS receiver to solicit replies from the on-board ATCRBS transponder. These replies would be received and processed by the ground based ATC system and presented to the controller's display with a resolution sufficient for control of closely spaced V/STOL terminal area traffic.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

1.0029, DEPARTURE TRENDS FOR CCV AIRCRAFT

W. Bihrle, Bihrle Applied Research Inc., *400 Jericho Tpke., Jericho, New York* 11753 (DF133680; F33615-78-C-3600)

One problem area experienced by aircraft designers is their inability to adequately predict high-angle-of-attack characteristics. The mission to be supported is FG02, development and improvement of flight control design techniques. The objective of this effort is to identify trends in the departure characteristics of statically unstable aircraft at high angles of attack. The proposed effort will contribute to a better understanding of expected departure trends and thus provide knowledge to enhance safety of flight and to permit maximum maneuverability.

The departure characteristics of statically unstable aircraft will be evaluated by use of 6-degree-of-freedom digital computer programs. These characteristics will include the effects of variations in key stability and control parameters. The influence of flight control system augmentation including control position and rate limits will be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, COMPOSITES COST TRACKING DATA AND ANALYSIS

R.J. Coletti, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF139530; F33615-77-C-3022)

This work unit supports the effort to build up an accurate airframe design-to-cost capability. The advantages to be offered by this specific effort include the ability to estimate the cost of advanced composite airframe structures. The objective of this program are detailed manufacturing cost data for production aircraft structural components manufactured from advanced composite materials and validation of the advanced composites cost estimation model which was developed under a previous Air Force contract. This work will help in the design of military aircraft structures which meet mission requirements with the lowest life cycle costs.

Cost data will be generated from actual observation of various steps in the manufacturing processes of composite parts and the recording of the manhour data on a part-by-part, operation-by-operation basis. The cost model computer program will be exercised to make analytical predictions of the manhours and these will be checked against the actual hours recorded.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, ACTUATION SUBSYSTEM EFFECTIVENESS ENHANCEMENT

G.D. Jenney, Dynamic Controls Inc., *Dayton, Ohio* (DF139940; F33615-77-C-3077)

Actuation subsystems now contribute over 50 percent of the total cost of the flight control system and accounts for a large share of the logistics support requirements of military air-

craft. The objective is to reduce the flight control initial and life cycle costs by developing less complex systems more suitable for universal applications, developing lower cost component parts and developing criteria for increased commonality. Simpler componentry and modularization will reduce acquisition and life cycle costs. Particular emphasis shall be applied to the development of a basic 'fly-by-wire' redundancy scheme of superior performance for general application. The resulting 'predesigned' systems shall be optimized to exhibit improved reliability and maintainability. Matching the performance requirements of the aircraft with the control surface actuators will eliminate oversizing of actuators or sacrificing of performance at key portions of the flight envelope.

Investigate and develop techniques to simplify or eliminate major subassemblies, to promote modularization of actuators, to reduce component complexity and cost and to perform required functions (e.g. position and rate sensing) via alternate methods. Demonstrate the application of higher bandwidth actuators, investigate improved interfacing techniques, alternate redundancy schemes and methods for reducing life cycle costs for flight control systems. Set up and conduct evaluation tests, in the flight control actuation and hydraulic facility located in Building 145, Wright-Patterson AFB, on equipment such as integrated actuator package and integrated valve-actuator assemblies. In addition, wind tunnel test a flutter suppression actuator to evaluate advanced actuation equipment developed during a prior program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, COMPRESSIBLE SUBCRITICAL AIRFOIL DESIGN AND TEST

G.M. Gregorek, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (DF141270; AFOSR-78-3476)

This work unit supports the development of advanced USAF high-altitude, long-endurance aircraft. Presently, high-altitude, long-endurance aircraft used for military missions are limited in altitude and payload capability. Advanced technology airfoils will help alleviate these lifting surface associated problems. This work effort is the design and wind tunnel test of compressible subcritical airfoils for future USAF aircraft, using a previously developed airfoil methodology. Use of these advanced technology airfoils will permit flight envelop expansion on future military high-altitude, long-endurance air vehicles.

A compressible inverse airfoil design procedure developed for AFFDL/FXM will be used to configure several high performance airfoils for high-altitude, long-endurance aircraft applications. The most promising of these designs will be tested two-dimensionally in the Ohio State University transonic wind tunnel facility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0033, REDUCTION OF RAW EXPERIMENTAL DATA

P.A. Graf, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF137600; F33615-77-C-3057)

Significant amounts of experimental data are currently being acquired during in-house test programs on parachutes and other equipment for military vehicle recovery applications. The data reflect performance and design characteristics of new fibrous parachute materials and design parameters for impact attenuation devices for RPV landing applications. The objective of this effort is to provide for the expeditious reduction of the data in a form suitable for analysis and evaluation. The availability of the reduced data shortly after completion of experimental tests will reduce the technical and cost risks during concept evaluation and development of fibrous parachute materials and permit immediate improvement in impact attenuation systems used on RPV's.

Raw experimental test data acquired during in-house programs is submitted for reduction, conversion into physical quantities measured, and plotting and/or tabulation as a function of selected parameters. Raw experimental data may consist of force, pressure, velocity, acceleration or displacement versus time traces recorded on oscillograph paper, of photographic recordings of moving or shape-changing objects, of still photographs and other recording or indicating apparatus.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0034, CRASHWORTHINESS DESIGN PARAMETER SENSITIVITY ANALYSIS

A.E. Tanner, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G0419; DAAK51-79-C-0042)

Minimize the adverse impact of crashworthiness design criteria on the cost, weight and performance of future Army helicopter designs and identify R&D efforts required to reduce the cost and weight associated with crashworthiness requirements.

The work to be performed under this procurement shall investigate the effect of MIL-STD-1290 crashworthiness requirements on future light helicopters. Both metal and composite airframe structures shall be investigated. Trend data shall be developed for crashworthiness cost and weight as a function of helicopter weight and as a function of the level of crashworthiness specified. Crashworthiness cost drivers are to be identified to assist in determining future R&D efforts necessary to reduce the cost of incorporating crashworthiness into future helicopter designs without reducing the level of crash impact protection from that specified in MIL-STD-1290.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0035, INVESTIGATION OF THE CRASH IMPACT CHARACTERISTICS OF HELICOPTER COMPOSITE STRUCTURES

J. Cronkhite, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0G0418; DAAK51-79-C-0037)

A. To investigate the crashworthiness of composite helicopter airframe structures in comparison to similar metal structures, b. To develop design, test, and analytical procedures for crashworthy composite helicopter airframe structures.

During Task I, a review of work-in-progress, preliminary designs of crashworthy composite fuselage structures, and design support testing will be performed. During Task II, the contractor will perform the analytical, crash impact testing data analysis, and correlation effort required by the Task II test plan.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0036, RESEARCH IN STRUCTURES

J.L. Shipley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Research & Technology Lab., *Hampton, Virginia* 23665 (DA0E3550)

To conduct basic research for fundamental structures and materials application technology necessary for a viable structures program. efforts include analytical techniques for complex structures, development of fatigue and fracture mechanisms in composite materials, the demonstration of advanced materials on helicopters, and the improvement of prediction techniques for structural dynamics.

In conjunction with NASA-LRC, analytical techniques for complex structures will include the application of minicomputers in finite element analysis and participation in the IPAD program. In the analysis and prediction of fatigue and fracture composites, experimental data will then be incorporated into a statistical model for fatigue behavior of graphite epoxy. Environmental effects on fatigue will be continued. The evaluation of environment effects and durability of composite components in a service environment and comparison to specimens under the same environment will be initiated. The composite fuselage investigation will continue a program to develop an efficient technique for attachment of hardpoints to an all composite panel. The crash impact energy absorption capability of composites will be compared to conventional sheet metal construction designed to the same static strength requirements. Fuselage

structural dynamics will explore other finite element techniques to helicopter dynamic response.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0037, RESEARCH IN AERODYNAMICS
J.L. Shipley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Research & Technology Lab., *Hampton, Virginia* 23665 (DA0E3553)

To conduct basic and applied research to develop or improve analytical techniques, prediction techniques, measurement techniques, and design data related to rotary wing airfoil development, unsteady aerodynamic phenomena, rotor wake characteristics, and tip vortex generation and propagation. Investigations are selected based on continual review of the Army's aviation objectives and assessment of those fundamental technology shortcomings which would prevent or restrict achievement of these objectives.

In joint participation with NASA, analytical and experimental programs will be conducted to develop rotor airfoils which are based on mission profiles and empirically derived environments. Unsteady experimental and analytical research will be conducted to develop an understanding of, and the capability to analyze and predict, rotor unsteady aerodynamic characteristics. Experimental programs will be conducted to quantify rotor wakes, to develop methods for drag reduction and to determine rotor performance and helicopter interference effects.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0038, AERONAUTICAL TECHNOLOGY, TECH AREA I - AERODYNAMICS TECHNOLOGY
J.L. Shipley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Structures Lab., *Mail Stop 266, Hampton, Virginia* 23665 (DA0E3551)

Develop and demonstrate the technology, techniques, and design criteria necessary to provide adequate performance, stability, control, and handling qualities for the Army's rotary wing missions, and to improve the capability to analyze and predict these characteristics in existing and future aircraft. This technology is necessary to increase aircraft availability and survivability as well as provide for improved operational effectiveness and mission capability of Army aviation systems.

Objectives are accomplished by conducting analytical, ground-based simulations, whirl tower, wind tunnel, and flight test investigations in joint participation with NASA. Research will include wind tunnel and flight test of advanced air-foils and tip shapes, design of a v-tail configuration and improvements in forward flight performance analysis. Acoustics research will be conducted to identify noise sources, improved prediction capability, and development of methods for reducing noise without performance degradation. The all-weather terminal area operations program will be continued to develop criteria with respect to handling qualities, control, and display requirements. Analysis and flight tests will be conducted to continue improvement in the area of helicopter stability derivative extraction. In addition, evaluation of the Dape tip on the AH-1 IMRB techniques will be conducted through flight tests.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0039, HEAD UP DISPLAY FOR KC-135 BOOM OPERATORS CONTROL STATION
F. Brem, Sundstrand Data Control Inc., *Overlake Industrial Park, Redmond, Washington* 98052 (DF142460; F33615-78-C-3617)

This work unit supports the division mission FG03 by developing an innovative flight control concept for safely expanding the operational capability of the KC-135 aerial refueling aircraft. A major problem associated with aerial refueling is the precise control of the boom. The boom operator at present must visually estimate distances and angles while operating controls which cannot be seen simultaneously with the real world. The objective of this work unit is to evaluate a head-up display as a solution to this program. If a head-up display can aid the boom operator in precisely controlling the refueling boom, the Air Force can save resources in the training of boom operators (now in critical supply), and reducing the number of accidents attributed to boom operator fatigue.

The solid-path HUD developed by the AFFDL will be installed and evaluated in an operational KC-135 aerial refueling aircraft to determine its potential usefulness as a boom operator's aid.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, TDRS TRANSPONDER DEVELOPMENT
Unknown, U.S. National Aeronautics & Space Admin., Goddard Space Flight Center, *Greenbelt, Maryland* 20771 (310-20-37)

Work under this RTOP is directed toward improving the TDRS user spacecraft transponder for missions starting in FY-84. Highest priority should be given to improvements that reduce cost. Size and weight reduction are no longer of great significance and modest increases in these areas can be tolerated in new design. Lower power consumption is still a significant factor in all new design but not considered essential to address as a single issue. A TDRS only mode is not considered in the immediate effort because of the flexibility this option affords for spacecraft checkout. If desired, this design change can be easily accommodated at a later date. Improvements are expected in parameters required for TDRS support, in enhanced system performance levels, and in enhanced system operational characteristics. The program would also improve the design by replacing obsolete or difficult to procure parts.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

2.0002, SPACE TRANSPORTATION SYSTEM (STS) & GALILEO DNS TECHNICAL SUPPORT
T.A. Schmidt, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF194360)

To provide technical nuclear safety support to HQ USAF and, in particular, the DOD Interagency Nuclear Safety Review Panel (INSRP) coordinator for the formal nuclear safety evaluations of the Space Transportation System (STS) and the proposed NASA Jupiter Orbiter Probe (JOP) or Galileo Spacecraft/Mission. IAW AFR 122-15.

This effort will involve many and varied tasks including-technical meeting support, document evaluation, performance of technical studies or analysis, performance independent nuclear safety/risk evaluation of the Galileo mission, which will be presented to the INSRP for consideration and review. An AFWL technical report will not be processed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

2.0003, SPACE SHUTTLE REMOTE MANIPULATOR DYNAMICS
W.T. Fowler, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: An analysis of the remotely operated arm (Remote Manipulator System) to be used during the payload handling phase of a typical space shuttle mission is currently underway. The analysis considers such topics as control algorithms, singularity management, possible operation tests sequences, and a study of the general dynamic behavior, such as RMS joint forces and moments under the full envelope of load-

ing conditions. Also, procedures are being considered to evaluate (for astronaut training purposes) a Shuttle Engineering Simulator located at the Johnson Spacecraft Center in Houston. This is the second year of continuing research.

SUPPORTED BY University of Texas

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, INVESTIGATION OF THE CNTD MECHANISM AND PROPERTIES OF SIC AND ALN DEPOSITION

R.A. Holzl, Chemetal Corp., *Pacoima, California* 91331 (DF054420; F49620-79-C-0041)

AF function - ceramic materials are being developed for a variety of components (e.g., blades, vanes, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Opportunity - a new CVD-like process known as CNTD (controlled nucleation thermochemical deposition) has been developed for producing very fine-grained materials having superior mechanical properties. Objective - the objective of this research is to study the mechanism and deposition parameters of CNTD for fine-grained, high-strength silicon carbide and aluminum nitride. How work contributes - silicon carbide deposits will be further evaluated by the Air Force for strength, toughness and corrosion resistance for possible impact on the ceramic turbine engine program. Silicon nitride samples will be further characterized for optical, dielectric and thermal properties under concurrent AFOSR research contracts.

The optimum deposition parameters for CNTD will be established to produce fine-grain, high-strength silicon carbide and aluminum nitride. Microstructure and mechanical testing data will be used in an iterative development cycle for optimizing the process. Variables to be studied include, gas chemistry, gas preheat, gas flow, partial and total pressure, substrate temperature, methods of heating and geometry of the sample and deposition system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, INFRARED PROPERTIES OF HIGHLY TRANSPARENT SOLIDS

M. Braunstein, Hughes Aircraft Co., Research Laboratories, *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (DF052990; F49620-78-C-0094)

AF function - high-energy laser technology is finding wide application in future Air Force systems. Opportunity - both in the generation of intense infrared coherent radiation and in hardening of certain critical components to this radiation, understanding the basic interactions of photons with transparent solids is of extreme importance for the advancement of high energy lasers. Objective - the primary purpose of this research is to investigate the source and nature of residual absorption in highly transparent solids in the infrared spectral region. The extrinsic mechanisms of infrared absorption are studied experimentally in thin-film coating materials and ultra-pure bulk materials grown by the reactive atmosphere process. Optical properties are correlated with chemical and physical properties and structure in these ir transparent materials. How work contributes - the knowledge and understanding gained could be of practical importance to the operation and performance of high power lasers and to the hardening of window materials.

Infrared laser calorimetry will be utilized to measure absorption coefficients. Measurements on long specimen bars should yield information on extrinsic absorption mechanisms in bulk, surface and films. Modulated light infrared ellipsometry will be used for studying the optical and mechanical properties of thin films and surfaces and to measure refractive indices, thickness and optical anisotropy resulting from strain induced thermal expansion and lattice mismatch. Structural and mechanical properties of films and surfaces produced by ultra high vacuum techniques will be examined by electron microprobe and scanning electron microscopy. Coating and bulk materials will be grown by the reactive atmosphere process.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, INVESTIGATION OF ELECTROCHROMIC DIPHTHALOCYANINES

M.M. Nicholson, Rockwell International Corp., *3370 Miraloma Ave., Anaheim, California* 92803 (DF048120; F49620-79-C-0104)

AF function - future Air Force operations require improved electro-optical and electronic materials for use in flight control, reconnaissance and surveillance, and signal processing and control devices. Deficiency - a need exists for new materials which can be exploited for the design of new concepts and classes of electro-optical devices. Objective - the objective is to determine mechanisms and rate parameters for electrochromic transformations in rare-earth diphthalocyanine complexes. How work contributes - the research will provide a new class of electro-optical materials which may find applications in visual displays, large-array memories, and other electronic devices.

The mechanisms and rate parameters for electrochromic transformation in rare-earth diphthalocyanines will be determined. The kinetics of the electrode processes will be determined from electrical and optical transient responses. The methods of investigation will include in situ spectroelectrochemical measurements, thin-layer electrochemistry, and charge-carrier injection techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, MECHANICAL BEHAVIOR OF AIRFRAME MATERIALS

N.E. Paton, Rockwell International Corp., *1049 Camios Dos Rios, P.O. Box 1085, Thousand Oaks, California* 91360 (DF042380; F44620-76-C-0025)

AF function - titanium and its alloys have been of considerable interest to the AF because of very favorable strength-to-weight characteristics at temperatures from cryogenic up to 800 degrees F, and resistance to attack by many chemicals. Potential applications for skins, structural and engine components of high performance aircraft, cryogenic fuel storage tanks for missiles, and tubing for transporting corrosive fuels all emphasize the available materials roles for titanium alloys. Opportunity - despite improvements in processing techniques, all commercial titanium products contain residual hydrogen which can, under certain conditions, influence their mechanical behavior. The effects of such residual hydrogen on the properties of titanium are of primary importance from a practical point of view, but these effects are incompletely understood in the more complex commercial alloys. Consequently, hydrogen is often overlooked as the cause of variability in the mechanical behavior of these alloys. Objective - this research will determine the influence of hydrogen on mechanical properties such as loss of ductility, decrease in fracture toughness, increase in creep rate, and increase in both sustained load and fatigue crack growth rates. How work contributes - the mechanisms by which internal hydrogen influences these and other mechanical properties are not well understood.

A systematic study of the effect of hydrogen content and aluminum content on the stress field around hydrides, and an investigation of tensile, creep, fatigue and sustained load cracking properties of Ti-Al and Ti-Sn specimens, with and without notches, and over a range of temperatures, will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0005, ENERGY TRANSFER REACTIONS OF EXCITED ATOMS AND MOLECULES 14708-C

G. Black, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DA0F9016; DAAG29 77 C 0018)

To determine the kinetics for reactions involving oxygen molecules and atoms with various species prevalent in the upper atmosphere. Relevance: The kinetic data to be determined will have application in on-going Army programs in combustion,

laser, and possibly in optical surveillance systems and in atmospheric modeling.

A range of spectroscopic techniques including photon counting, resonance fluorescence and absorption, time-resolved radiative decay measurements, pulsed flash lamps, and laser excitation will be utilized in the investigation to be undertaken.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0006, SURVEILLANCE - METASTABLE RARE-GAS HALOGEN INTERACTIONS

D.C. Lorents, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DN675452; N00014-76-C-0734)

In this work energy transfer from excited atomic systems to diatomic molecules is being studied. Elastic, inelastic, and reactive processes are being monitored. The emphasis is on studying potential curve crossing in atom-molecule collisions. These are important processes in molecular lasers and ceratin ionospheric processes, but have not been well studied in the past due to their complexity. It is important that these processes be better understood since they are important in the naval areas of communication and surveillance.

The competition between various final channels in He metastable and Ar metastable atom collisions with no are being studied. The apparatus is being modified to facilitate the determination of total destruction cross sections.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0007, PROPERTIES OF THE EXCITED STATES OF MOLECULAR IONS 15069-P

J.T. Moseley, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DA0F9093; DAAG29-77-C-0037)

The objective of this program is to determine properties of vibrationally and electronically excited states of molecular ions. Relevance: The proposed research program complements Army interest in the normal and disturbed atmosphere, gas discharge processes, and various lasers of military interest such as carbon dioxide and excimer lasers. It is expected that many of these devices and modelling efforts will depend critically on properties of the excited states of molecular ions.

Measurements of the photodestruction of ions in excited states will be undertaken and new techniques developed. Collisional de-excitation of ions in excited states will be determined for individual vibrational levels. Techniques for the measurement of ion molecule reactions involving excited states will be developed. Single quasi-bound excited states will be produced with laser excitation and then the energy and lifetime of this level measured using a photo-fragment spectrometer.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0008, AN INVESTIGATION OF THE MECHANISMS OF HOT, MULTI-PHASE EROSION/CORROSION PHENOMENA 15812-MS

J.W. Kury, University of California, Central Office, Lawrence Livermore Lab., *P.O. Box 808, Livermore, California* 94550 (DA0F9282)

To investigate the fundamental mechanisms of erosion of materials in hot flowing media, and to study mechanisms of protection of materials in such environments. Relevance: The effort is relevant to army needs in the areas of gun tube erosion, and in erosion of gas turbines for helicopters and propulsion components in missiles.

This multidisciplinary research effort will include, but will not be restricted to, the following: (1) unsteady two dimensional dust laden turbulent reactive flow analysis with exposed, characterized material surfaces; (2) theoretical flow and turbulence modeling and energy exchange; (3) development of numerical simulation methods for three dimensional effects such as swirl, non-uniform curvature and asymmetric cross-flow; (4) extension and development of multiple energy momentum field equations for two-phase interactions; (5) extension of models to include effects of solid material phase thermodynamic and stress states, solid wall material loss, scale layer formation, surface analysis, diffusion, gas/solid interface exchange, and non-equilibrium thermochemistry; (6) dusty gas flow/material surface interaction, heat transfer/material erosion high pressure, high temperature experiments in plasma arc jet and/or shock tube; laser beam interaction, surface state/material loss mechanisms; (7) experimental investigation of surface macrostructure, microstructue, and composition changes, phase transformation, solid state and relation to erosion; (8) investigation of novel structures and compositions (e.g., amorphous materials, composite layers, etc.) and their influence upon erosion. During the initial ten months period of effort work will proceed in as many of these areas as possible with the intention of gaining focus on the direction of further efforts.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0009, CHEMICAL REACTIONS OF ATMOSPHERIC HALOGENATED SPECIES

M.J. Molina, University of California, Irvine Campus, School of Physical Sciences, Dept. of Chemistry, *Irvine, California* 92664 (R805532-02; GC1V -0517)

OBJECTIVE: The objective of this research program is to better the understanding of the transformation and removal of halogenated pollutants in the environment.

APPROACH: UV absorption cross sections will be obtained for selected brominated compounds, FTIR studies of semi-stable molecules of atmospheric significance will conducted, and field measurements of methylchloroform will be made.

PROGRESS: Absorption cross sections were obtained for CBr2F2, CBrClF2 and CBrF2CBrF2.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

3.0010, IDENTIFICATION OF FLAWS IN HIGH PERFORMANCE CERAMICS

G.H. Sines, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Materials, *405 Hilgard Ave., Los Angeles, California* 90024 (DF049820; AFOSR-77-3425)

AF function - ceramic electromagnetic windows for radar and target acquisition allow combat aircraft to operate in all weather conditions. Deficiency - ceramic windows are, however, subject to brittle fracture originating from preexisting defects. Objective - the objective of this research is to identify the source and character of the defects which lead to mechanical failure in ceramic components. How work contributes -identification of the sources of failure is necessary in order to design nondestructive evaluation (NDE) techniques to find and reject components having unacceptable preexisting defects.

An eccentrically loaded column bend test will be developed to enable a number of small cracks (equivalent to 20) to grow without catastrophic failure occurring from just one worst flaw. The selective nature of slow crack growth from certain categories of flaws will be determined. New techniques which permit the identification of many flaws (greater than 10 to the 4th power) from the study of microspallation of a single compressively loaded specimen will be correlated with tensile fracture initiation sites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0011, MEASUREMENTS OF TRACE GASES AND THEORETICAL STUDIES IN ATMOSPHERIC CHEMISTRY

R.J. Cicerone, University of California, San Diego Campus, Scripps Institution of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (ATM79-23774)

This research includes both theoretical and observational studies of atmospheric chemistry. Numerical modeling investigations will be done on tropospheric photochemistry in both one and two dimensions. A central objective is to understand the

factors that control the concentrations, distributions, and variations of tropospheric OH, HO2, NO, NO2, O3 and other key species, especially those that are now being measured by tropospheric workers.

One-dimensional stratospheric models are being completed, with the objective of evaluating the stratospheric effects of human activities, for testing the effects of altered photochemical schemes and of new chemical reaction rates, and for steady state calculations such as altitude integrations of chemical sinks. Photochemical schemes will include reactions of bromine, chlorine, nitrogen, and hydrogen oxide species.

Flux measurements will be made of emissions from the Earth's surface of methane and nitrous oxide. Field studies will emphasize the identification of 'hot spots' of emission of these gases and of halocarbons and sulfur species.

This project continues work carried on under Grant ATM-7826728-A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

3.0012, DETECTION OF MATRIX STRESSES IN GRAPHITE/EPOXY COMPOSITES

P.K. Predecki, University of Denver, School of Engineering, Dept. of Chemical Engineering & Metallurgy, *2115 S. University Blvd., Denver, Colorado* 80210 (DF048180; AFOSR-77-3284)

AF function - the function of nondestructive evaluation (NDE) in the Air Force is to save lives and resources through timely examination of aircraft and engine components to assure their continued safe operation. Deficiency - many inspection techniques have been developed for metals, however, despite the increasing use of polymer composites, there has not been an adequate development of NDE techniques for these materials. Objective - the objective of this work unit is to conduct research on the detection of matrix stresses in graphite/epoxy composites by NDE techniques. How work contributes - matrix stresses are indicative of the soundness of the composite and indicate degradation such as debonding, fiber breakage, and humidity infiltration.

A new application of x-ray stress analysis for detecting residual and applied stresses in the matrix of graphite-epoxy composites will be investigated. The method makes use of small amounts (less than 20 WT percent) of crystalline filler placed in the matrix of any desired ply or plies during the fabrication process.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, ENVIRONMENTAL EFFECTS IN STRESS CORROSION CRACKING IN ALUMINUM ALLOYS

R.T. Foley, American University, School of Arts & Sciences, Dept. of Chemistry, *Mass. & Nebraska Aves. N.W., Washington, District of Columbia* 20016 (DN475438; N00014-75-C-0799)

The objective of this task is to clarify the role of environmental factors in stress corrosion cracking of aluminum alloys used in Navy aircraft and craft.

An experimental program is to be conducted to study the effect of various anions in pitting initiation in aluminum alloys, a study of local solution chemistry in these alloys, and a testing phase to correlate the first two approaches with susceptibility of the alloys to stress corrosion cracking. Standard electrochemical and fracture mechanics techniques are to be used for this study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, PIEZOELECTRIC POLYMER DEPOSITION--RELATION OF DEPOSITED STRUCTURE TO ACTIVITY 13790-P

S. Edelman, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (DA0E9035)

(1) To develop piezoelectric and pyroelectric polymers which will have enhanced electrical properties and will minimize our dependence on overseas sources of these materials and (2) to develop a better understanding of the mechanisms of these piezoelectric and pyroelectric polymers. It has already been shown that these films have the potential of directly replacing lead zirconate-lead titanate in fuzing applications with improved performance at a lower cost. As pyroelectric elements these materials can potentially replace triglycine sulphate in pyroelectric vidicons (in at least one case this has been sucessfully demonstrated).

Deposit piezoelectric polymer in vacuum under a strong electric field. Determine the structure of the deposited polymer and the level of piezoelectric and pyroelectric activity. Using both theoretical and experimental approaches, relate the parameters controlling the deposition of the material to the resulting structure and to the piezoelectric and pyroelectric activity.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0015, INTERDISCIPLINARY CERAMIC MATERIALS RESEARCH

Unknown, U.S. National Aeronautics & Space Admin., *600 Independence Ave. S.W., Washington, District of Columbia* 20553 (505-33-10)

The objectives of this RTOP are to develop: (1) an understanding of the nature and properties of ceramic materials; (2) a processing and design methodology for these materials; and (3) an educational program for training graduates and undergraduates in research, design, and application of these materials in engineered structures. The University of Washington will emphasize research and application of ceramics for severe environments, e.g., aircraft gas turbines and energy conversion systems. Engineering and science departments other than materials will participate in both the research and educational development programs.

SUPPORTED BY U.S. National Aeronautics & Space Admin.

3.0016, FLOW AND FRACTURE PROCESSES IN POWDER METALLURGICAL NICKEL-BASE SUPERALLOYS

M.J. Blackburn, United Technologies Corp., Pratt & Whitney Aircraft Div, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF047550; F49620-77-C-0083)

AF function - nickel-base superalloys, because of their unique high temperature properties, find extensive application in the turbine section of gas turbine engines. Opportunity - as the performance requirements of such aerospace power plants become more demanding, the material properties must be improved to compensate for the more severe operating conditions. However, the specific property improvements required in an alloy depend upon the component for which it is to be used. For the airfoil section of a blade, high temperature creep and rupture properties coupled with good thermal fatigue resistance are critical properties. For a turbine disk, which operates at lower temperature, improved engine performance translates into requirements for higher strength materials with superior stress rupture characteristics. Objective - this research will obtain insight into the factors and mechanisms that control the strength and stress-rupture properties of powder metallurgy nickel-base superalloy disks fabricated by hot isostatic pressing. How work contributes - as such, it will contribute to AF programs to exploit advanced cost-effective manufacturing methods (hot isostatic pressing of nickel alloy powders) for the production of critical engine components.

Two basic mechanical properties of nickel-base superalloys fabricated by powder metallurgy techniques have been selected for study - stress rupture, and strength with emphasis on the yield stress. Several alloy compositions, including MERL-76, will be selected for detailed mechanical and microstructural characterization. Quantitative models will be constructed of the mechanical processes, and related to experimental observations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, DYNAMICS OF COMPOSITE MATERIALS AND ELASTIC STRUCTURAL ELEMENTS WITH VARIABLE DIMENSIONS - 15872-E

S. Nemat Nasser, Northwestern University, Evanston Campus, Technological Inst., Dept. of Civil Engineering, *633 Clark St., Evanston, Illinois* 60201 (DA0F9277; DAAG29-78-G-0149)

The development and exploitation of a new methodology for an effective and accurate response of elastic composites and the vibration of elastic structural components which have relatively large variations in their stiffness, mass distribution and/or dimensions. Relevance: The dynamic response of optimized lighter weight missile and aircraft structures constructed of composite materials requires critical analysis. The use of composites with meaningful dynamic analysis will result in improved helicopter components.

Appropriate mixed variational principles will be used in connection with either a Ritz-type approximation (for composites and structures with regular geometries) or with a finite element approach (for irregular geometries).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0018, RECOVERY MECHANISMS IN POLYMERS - 16274-MS

R.P. Wool, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (DA0G9115; DAAG29-79-C-0142)

The research will include the investigation of damage and recovery processes in mechanically stressed multicomponent polymer systems. Relevance: The research may find application in a wide range of Army systems, including new elastomers for vehicular mobility, polymeric materials for use in housings and airdrop containers, etc.

Semicrystalline polymers, block copolymers, filled elastomers and composites will be examined to determine the molecular and microstructural mechanisms of deformation and recovery. Damage processes involving permanent, instantaneously reversible and time-dependent reversible changes will be studied. The mechanical aspects of recovery will be investigated using a humidity and high/low temperature controlled tensile tester. The molecular and microstructural processes will be investigated by electron microscopy, infrared, nuclear magnetic resonance, x-ray and other techniques, before, during and after deformation. Damage and recovery mechanisms will be quantitatively related to the mechanical properties of each system over a range of strain and thermal histories. Methods of accelerating recovery in damaged or fatigued materials will be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0019, MODELING AND MODIFICATION OF THE ELECTROMAGNETIC PROPERTIES OF ADVANCED COMPOSITE MATERIALS

W. Gajda, University of Notre Dame, School of Engineering, Dept. of Electrical Engineering, *Notre Dame, Indiana* 46556 (DF050250; AFOSR-77-3453)

AF function - recent increased use of composite materials in AF systems has required knowledge of the electrical properties of such materials. The vulnerability of the aircraft with composite components to nuclear EMP is of importance. The vulnerability is determined, in fact, by the conductivity of the composite materials. Opportunity - this research will provide basic information useful in assessing the survivability of AF systems with composite components. Objective - the objective of this study is to understand the nature of selected advance composite materials and to subsequently develop materials with desired properties. Contribution - this research will contribute to the basic knowledge of the properties of composite materials.

This investigation will approach the goal of modification of the electrical properties of advanced composite materials by - (1) developing doping techniques to increase the conductivity of fibers used in composite materials, and (2) formulating models based upon statistical theory of random media to allow prediction of conductivity and permittivity of fiber reinforced material.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, INELASTIC AND REACTIVE COLLISIONS INVOLVING LiH MOLECULES - A COLLABORATIVE EXPERIMENTAL AND THEORETICAL STUDY

P.J. Dagdigian, Johns Hopkins University, School of Arts & Sciences, Dept. of Chemistry, *34th & Charles Sts., Baltimore, Maryland* 21218 (CHE78-08729)

This research is in the area of quantum chemistry. It represents a collaborative study of the dynamics of rotational and vibrational energy transfer by investigators at the Department of Chemistry and at the Applied Physics Laboratory of Johns Hopkins University and at the University of Maryland. Research is planned in three major directions: 1) The laser-induced fluorescence study of rotationally inelastic collisions of state selected LiH molecules will be expanded to include various polar molecule targets, which will permit a direct investigation of R yields R energy transfer. The ab initio many-body perturbation-theory LiH-atom surfaces will be used to evaluate and calibrate various semi-empirical surfaces. Similar techniques will then be applied to the more complex LiH-molecule systems. 2) Vibrational energy transfer under single collision conditions will be investigated by using vibrationally excited target molecules, produced by infrared laser irradiation, to collisionally pump the LiH beam. 3) The on-going research effort will be extended to reactive collisions involving LiH, with particular emphasis on the isotopic exchange reaction 7LiH plus 6Li yields 6LiH plus 7Li. Ab initio calculations will be made to describe the necessary features of the adiabatic Li2H surface, which will then be used in studies of the reaction dynamics.

This research represents a continuation of that currently supported by Foundation grant CHE-7611359.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0021, ELECTRONIC AND OPTICAL PROPERTIES AND MODELING OF INTERCALATED GRAPHITE

M.S. Dresselhaus, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF049500; AFOSR-77-3391)

AF function - airborne systems utilized for command, control, communications, reconnaissance and surveillance depend heavily upon interconnected electronic components. Improved performance of these systems can be expected from the use of less expensive, lighter materials such as graphite intercalation compounds for electrical conductors. Opportunity - intercalated graphite compounds, weighing about one fourth of that of copper, could have conductivities greater than that of copper. Objective - the objective of this research is to study experimentally and theoretically the electronic structure, the optical properties and the intercalation mechanisms of intercalated graphites. How work contributes - this work should contribute to the development of graphite intercalation compounds that could replace copper as the dominant electrical conductor for airborne systems.

Raman and infrared spectroscopy will be used to examine in detail the vibrational modes associated with both the molecules absorbed on surfaces and the absorbing substrates. The frequency shifts together with the observed Raman and infrared selection rules will be interpreted to yield information on the orientation of the adsorbed molecules and on their ordering at the surface and in the bulk computer modelling will be used to establish intercalation mechanisms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, FRACTURE BEHAVIOR EVALUATIONS OF HIGH PERFORMANCE HELICOPTER GEAR MATERIALS

P.J. Fopiano, Amax Inc., Climax Molybdenum Co of Michigan, *1600 Huron Pkwy., P.O. Box 1568, Ann Arbor, Michigan* 48106 (DA0G4773; TO BE DETERMINED)

The Army is currently evaluating several tool steels for high performance gear applications. The alloy additions necessary to improve the scuffing resistance also tend to reduce the toughness of the steel. Since the fracture behavior is critical to the successful utilization of these steels in high performance power transfer systems, it is proposed to evaluate this fracture behavior in candidate steels.

It is felt that the major problem is the toughness of the candidate steels after exposure to the anticipated service temperature rather than the toughness at the service temperature. The program, therefore, would be to determine the impact fracture stress, fracture toughness, fatigue endurance limits, and resistance to repeated impact of case hardened (carburized) test specimens of the candidate steels before and after exposure to the service temperature. Residual stress and retained austenite gradients in the case would be determined by x-ray diffraction techniques.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0023, NAVY VEHICLE DESIGN AND CONSTRUCTION - STRENGTHENING MECHANISMS IN TITANIUM ALLOYS

D.A. Koss, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DN223465; N00014-76-C-0037)

The high strength-to-weight ratio and corrosion resistance of titanium alloys make them highly desirable for use in aircraft and submarine structures. This research effort will examine mechanisms of plastic flow in titanium alloy sheet and complicating effects of crystallographic texture and hydrogen atmosphere.

Ti-6Al-4V sheet with strong textures that influence through thickness deformation will be deformed under uniaxial and multiaxial loading to examine the mechanisms of slip, strain localization, and fracture. Hydrogen-assisted cracking in single and polycrystal alpha Ti-7Al and metastable beta Ti-28V will be explored. Variables include crystallographic orientation, heat treatment, and specimen geometry.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0024, MORPHOLOGY AND KINETICS OF STRAIN-INDUCED CRYSTALLIZATION OF POLYMERS DURING *FLOW 15299-MS*

G.S. Yeh, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Metallurgical & Materials Engineering, *Ann Arbor, Michigan* 48104 (DA0G8956; DAAG29-79-G-0029)

To extend work on stress-induced crystallization (SIC) of elongational non-flow polymer systems to shear flow systems in order to formulate a SIC theory comparable to one currently available for quiescent crystallization. Such a study would provide guidelines for polymer processing or fabrication which involves SIC (e.g., fiber spinning, film extrusion). Relevance: The research may find Army applications in a variety of end items, from personnel armor to helicopter components to encapsulation of chemical components and smoke ingredients.

Based upon earlier findings relating SIC crystal thicknesses and crystallization kinetics to crystallization temperature, strain, and/or strain rate, morphological and kinetic studies would be carried out. Polyethylene would be crystallized by shear in a dilatometer, including variables such as molecular weight variations. In addition, other polymers, such as polypropylene and polybutene, with increasing branch chain lengths, would be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0025, THEORETICAL MODELS FOR LOW-DIMENSIONAL EXCHANGE-COUPLED INORGANIC AND ORGANIC CRYSTALS

Z.G. Soos, Princeton University, Graduate School, Dept. of Chemistry, *205 Nassau Hall, Princeton, New Jersey* 08540 (CHE77-27418)

Research previously supported by CHE7607377.

Theoretical research on low-dimensional organic and inorganic crystals will be carried out. In order to understand these important systems, the current theories will be extended to the regime where exchange and thermal energies are comparable, in order to gain more than qualitative information from magnetic resonance experiments. This theory will be tested on a number of compounds which consist of chains (or layers) of transition metal complexes or of stacks of organic radicals. Among the effects to be investigated are the theory of triplet exciton transitions, variable ionicity and related problems in excitation dynamics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0026, MICROMECHANICAL PROPERTIES OF CRAZES - 16123-MS

E.J. Kramer, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science & Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0G8987; DAAG29-79-C-0015)

To conduct studies of the micromechanical properties and structure of crazes in polymers which are brought about under both dry and environmental conditions. Relevance: Crazing has been identified as a frequent precursor to fracture of polymeric materials which are important components of fuzes, gas masks, and other items of personnel protection and support, packaging, and aircraft canopies.

A new quantitative transmission electron absorption microscopy technique with very high spatial resolution will be used in the measurement of the micromechanical properties of crazes. The research includes comparisons of crazes grown in homogeneous stress fields and those in inhomogeneous fields; crazes grown in time-varying stress fields will be studied, as will the detailed structure and properties of the craze tip; molecular weight effects, strain hardening as related to molecular weight, and the influence of solute diffusion on the thickening mechanisms of environmental crazes are also amongst the topics to be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0027, MOLECULAR BEAM STUDIES OF REACTIONS OF LASER-EXCITED METAL ATOMS WITH GASES USING SPECTROSCOPIC DETECTION OF PRODUCTS

J.M. Parson, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Chemistry, *164 W. 17th Ave., Columbus, Ohio 43210 (CHE79-21267)*

This research is in the area of quantum chemistry. Dr. Parson intends to continue and expand a crossed molecular-beam study of reactions of excited metal atoms with gaseous molecules. The excited atomic states are to be formed with a single frequency tunable ring dye laser. Either reactive states will be pumped directly, or metastable states will be formed by pumping a higher radiative state. Quantities to be measured are translational energy dependence of cross sections and internal energy distributions of products using chemiluminescence or laser-induced flurorescence for detection. Emphasis will be on A plus BC reaction types where comparisons with theories promise to further understanding of the dynamics of reactions on electronically excited potential energy surfaces. A major goal is to identify types of atomic states which are particular reactive or lead to inverted product state populations. This re-

search represents a continuation of that currently supported by Foundation grant CHE 7611641.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0028, HIGH BURNING RATE PROPELLANTS
F.W. Fowkes, Lehigh University, School of Arts & Sciences, Dept. of Chemistry, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DA0G1112)

To establish the surface chemistry of ultrafine ammonium perchlorate (UFAP) and its effect on the burning rate mechanisms in carborane propellants.

Under a previous grant, investigations of the surface chemistry of the propellant oxidizer UFAP concluded that its dispersion in polymeric binders is controlled by electrostatic mechanisms. Studies will continue on effective means to mitigate poor dispersion and thus enhance propellant burning rates.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Technology Lab.

3.0029, REFINING OF CRUDE SHALE OIL INTO HIGH YIELDS OF JET FUELS
A. Schneider, Suntech Inc., Dept. of Applied Research & Development, *P.O. Box 1135, Marcus Hook, Pennsylvania* 19061 (ET-78-C-01-3210)

The objectives are to examine trade-offs between severe hydrorefining versus the combination of milder hydrorefining and HCl-precipitation of remaining nitrogen compounds and to determine hydrogen-producing potential of precipitated H-compounds. Paraho crude shale oil will be hydrorefined at 1500 PSIG hydrogen pressure to prepare samples containing 5000, 2000, and 500 ppM nitrogen. Yields and compositions of amine-hydrochlorides obtained by treating these samples with HCl will be determined. Yields and properties of jet fuels produced will be obtained. Kinetics of thermal decomposition of amine hydrochloride to recover HCl and nitrogen concentrate will be determined. Conditions of hydrorefining will be established such that hydrogen-producing potential of nitrogen concentrate is in balance with hydrogen requirements. A process will be defined for providing high yields of jet fuel from crude shale oil requiring less hydrogen than high-severity hydrorefining.

SUPPORTED BY U.S. Dept. of Energy, Div. of Fossil Fuel Extraction

3.0030, NUCLEAR MAGNETIC RESONANCE AND *ACOUSTIC NUCLEAR RESONANCE FOR NONDESTRUCTIVE* EVALUATION OF STRUCTURAL MATERIALS
G.A. Matzkanin, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (DF044200; F44620-76-C-0114)

AF function - the nondestructive evaluation (NDE) of aircraft structural materials plays an important role in safety and cost effective use of the fleet. Deficiency - there is a deficiency in techniques for determining the residual stress and strains introduced into materials during fabrication or subsequent use. Such stresses play important roles in fatigue damage processes, stress corrosion cracking, and hydrogen embrittlement. Objective - this research seeks to apply nuclear magnetic resonance (NMR) and acoustic nuclear resonance (ANR) techniques to NDE problems of practical interest to the Air Force. How work contributes - the specific features of NMR and ANR will be defined and developed for the quantitative characterization of internal strain and stress in nonferromagnetic structural materials, such as Al, Ti, composites, and nonmetallics.

Inductive NMR signals will be detected from specimens external to both the detecting coil and the magnetic gap by utilizing a pancake-shaped detection coil placed near the surface of the specimen, with the applied field produced by u-shaped magnets. Continuous and pulsed ANR techniques will be developed for polycrystalline materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0031, THE MOLECULAR STRUCTURE AND BEHAVIOR OF PHOSPHAZENES - 14913-C
R.H. Boyd, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Materials Science & Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DA0F9086; DAAG29-77-G-0197)

Studies in the structural and behavior areas of phosphazenes such as prediction of glass transition temperatures and crystal disordering transitions will be undertaken. Relevance: This research is highly relevant to the performance of polyphosphazenes in numerous areas of Army interest such as in helicopter seals, low temperature fuel hoses, fire resistant polymers and fluids, etc.

An improved molecular forcefield for making conformational energy calculations will be developed. Dielectric studies of relaxation processes in crystal disordering transitions will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0032, PARTIAL-WAVE METHODS IN MOLECULAR ELECTRONIC STRUCTURE CALCULATIONS
E.A. McCullough, Utah Higher Education System, Utah State University, School of Science, Dept. of Chemistry & Biochemistry, *Main Bldg., Office 104, Logan, Utah* 84321 (CHE76-08768 A01)

One goal of research in quantum chemistry is the quantitative prediction of molecular properties. In light of contemporary scientific problems involving molecules in the upper atmosphere or interstellar space, this goal increases greatly in importance, for the molecular species found in these environments are difficult to study by experimental methods. Hence, theory can and must make significant contributions in these areas. Despite recent advances in molecular quantum mechanics, there remains a group of molecular properties which are difficult to compute accurately. This is because most of the current techniques rely on a single computational method which is not well suited to the description of these properties. Professor McCullough has developed a different method involving partial-wave expansions and numerical orbitals. He has demonstrated that the method enables superior predictions of molecular polarizabilities and cusp ratios of wavefunctions, and has used this capability to determine how best to choose a basis set for calculating a specific molecular property in the traditional computational method. He will extend these studies to the study of negative ions and excited states of diatomic molecules and to higher-order electric and magnetic field related properties.

This research is a continuation of that supported under NSF grant CHE-7608768.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0033, *SYNTHESIS AND SPECTROSCOPIC INVESTI*GATION OF INORGANIC MATERIALS POSSESSING UNUSUAL ELECTRONIC PROPERTIES
G.A. Crosby, Washington State University, School of Arts & Sciences, Dept. of Chemistry, *Administration Bldg., Room 101, Pullman, Washington* 99163 (DF042400; AFOSR-76-2932)

AF function - advanced aircraft employ avionic and weapons systems with increased performance requirements. Deficiency - functional components for electromagnetic and electro-optical systems require materials with tailorable and predictable properties. Objective - the objective of this research is to utilize transition metal complexes and their charge-transfer excited states in solids to guide the design of new electronic materials. How work contributes - highly specialized materials could result in significant performance improvement in air force electronic displays, non-linear optics, electro-optical devices, and laser systems.

The research encompasses chemical synthesis, optical absorption, emission and reflectance measurements, and the determination of the effects of external magnetic fields on excited solid state properties of complementary inorganic complexes whose electronic structures suggest the incidence of strong

solid-state interactions where the units are incorporated with solids. These include complexes of D-6, D-8 and D-10 ions from all the transition series with emphasis on those whose low-lying excited states are charge transfer in nature and those with high electronic affinities. Special emphasis is placed on mixed-ligand materials and sulfur coordination. There will be increased emphasis on measurements at low temperatures as the role of isolated systems in solid state interactions become defined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0034, METASTABLE THREE ATOM COLLISION COMPLEXES AND CROSS SECTIONS

J.O. Hirschfelder, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Chemistry, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF041240; AFOSR-75-2850)

AF function - this research contributes to research objective 6.1, nuclear weapons effects. Deficiency - nuclear weapons effects studies require information on atomic and molecular species in metastable states. Observation of these states in the laboratory is difficult, and often information can be gotten only by theoretical means. Objective -this research pursues the development of theoretical techniques for dealing with highly excited states of molecules. Contributions -availability of theoretical techniques will permit the calculation of needed information.

In this theoretical research, the dynamical properties of three atom systems are investigated from two points of view. In non-reactive collisions between an atom and a diamotic molecule, cross sections are being calculated for collisions involving transitions from a particular rotation-vibration state to another state. For triatomic molecules, the properties of stable and metastable highly excited rotation-vibration states are being investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0035, CALCULATION AND ASSESSMENT OF INTERLAMINAR STRESSES IN LAYERED COMPOSITE MATERIALS

N.J. Salamon, University of Wisconsin, Milwaukee Campus, School of Engineering & Applied Science, Dept. of Mechanics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (DF053310; AFOSR-78-3680)

AF function - advanced lightweight flight vehicles will use composite materials to improve their structural efficiency. Deficiency - the interlaminar failure mode of composite laminates is not predictable within the desired confidence level. Objective - to develop improved methods for the prediction of interlaminar stresses in laminates and the associated failure strength. How work contributes -research results will aide in fully understanding the failure of complex laminates.

Initial studies will focus on the analytical and numerical methods which can be used to predict the singular stress behavior. Both solution accuracy and efficiency will be considered in assessing the feasibility of the solution methods. In addition, an experimental investigation will be conducted in order to achieve verification of the predicted behavior. Both damage initiation and growth will be studied in the laboratory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0036, THE GROWTH AND APPLICATION OF CADMIUM TELLURIDE

R.H. Williams, New University of Ulster, School of Physical Sciences, *Coleraine, Ireland* (DA0D9305; DAERO 77 G0026)

To grow and characterize large cadmium telluride crystals for possible application as an infrared window, gamma ray detector, and near infrared photodetector.

Large single crystals of the II-VI compound semiconductor CdTe will be grown by pulling from the melt, using a high pressure cyrstal puller. Crystals will be characterized optically and electrically. In particular the surface properties of the crystals, the nature of metallic contacts to them and the nature of space charge layers near their surfaces will be investigated in order to establish the influence of surface and interface effects on CdTe based devices. Attempts will be made to fabricate P-N junctions by diffusion of metals from the surface with the view to assessing CdTe as a device material.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, *Research & Standardization Group*

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, EFFECTS OF IMPULSE REPETITION RATES ON DETECTABILITY OF HELICOPTER-LIKE ACOUSTIC SIGNALS - *16729-L*

S. Fidell, Bolt Beranek & Newman Inc., *21120 Vanowen St., Canoga Park, California* 91303 (DA0G2281; DAAG29-80-C-0057)

To test hypothesis that different signal to noise ratios are required to maintain constant detection performance for spectrally matched pairs of impulsive and non-impulsive signals to different repetitive rates. Relevance: Helicopters can be detected from miles away, with the unaided ear. This prevents the use of helicopters for surveillance or commando action. Supports work at Moffett Field.

Refine steady state detection equations for application to detection of noise signatures dominated by blade slap. Use approximately six combinations of pulse shapes and repetition rates (10-80Hz). The pulse shapes and repetition rates, produced by recordings, should resemble in spectral content the blade slap of helicopters. Pairs of signals at three different absolute levels, with constant noise-signal ratio, will be used. Testing of detection by human observers will be computer controlled.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0002, CHEMICAL REACTIONS IN TURBULENT MIXING

H.W. Liepmann, California Inst. of Technology, Graduate School, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (DF042810; F49620-79-C-0159)

AF function - weaponry, airbreathing propulsion, aerospace vehicles. Deficiency - with the present state-of-the-art it is not possible to predict, a priori and with any confidence, the progress of a reaction in turbulent flow. This lack of understanding of reactions in turbulent flow makes it difficult to optimize the design of the reaction sections of gas lasers and turbine engines and thus increase the system efficiency. Objective - to accelerate the acquisition of the needed understanding of this turbulent chemical reaction problem. How work contributes - increased understanding of the interaction of energetic chemical reactions and turbulent gas flows will assist practical design of combustion components of a number of devices.

An experimental program will be followed to study the chemical reaction in a two dimensional free shear flow. Both liquid and gaseous fluids will be used, chemical reactions with and without heat release will be studied to evaluate the effects of heat release on the coherent structures within the shear layer. Product flux, distribution of amount, velocity field and density gradient data will be taken and analyzed. An active search for new and more effective instrumentation and scalar marking techniques will be pursued.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0003, MATERIAL SUPPORT TECHNOLOGY: SOLID PHASE EPITAXIAL GROWTH

M.A. Nicolet, California Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (DN675034; N00014-75-C-0912)

With the increasing complexity of Navy electronic systems, there exists a need to develop new fabrication techniques that will be suitable for precise processing for increased packing density of devices in large scale integrated systems. Solid-solid phase reactions and solid phase epitaxy coupled with ion implantation offer important new methods for realizing reasonably complex layered device structures with a minimum of processing complexity.

The investigator will investigate limits of concentrations of implanted ions in various semiconductor materials, both elemental and compound. Effects of sputtering under high dose rate conditions will be studied as a function of implanted ion mass. Annealing experiments to ascertain the degree of incorporation of impurities into the lattice will be investigated by electrical measurements along with ion beam analysis techniques, i.e., backscattering and channeling.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, POWER CONDITIONER UNIT

L. Hodges, Delta Electronic Control Corp., *1701 Pomona Ave., Costa Mesa, California* 92627 (DN781392; N62269-76-C-0224)

To develop a power conditioner unit to provide the aircraft electrical requirements of 400 cycle and 28V DC power from the HVDC BUS power. This contract supports work unit ZA601, agency accession no. DN681080.

To design the power conditioner unit utilizing advanced solid state design techniques to provide with improved performance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0005, ACQUISITION OF A SYSTEMATIC DATA BASE FOR WING ALONE CHARACTERISTICS AT HIGH ANGLES OF ATTACK - 16030-E

J.N. Nielsen, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DA0G9031; DAAG29-79-C-0020)

To obtain, experimentally, systematic wing-alone data base measurements which are as free as possible of support interference effects and which extend to higher aspect ratios. Relevance: The research is directly relevant to the prediction of aerodynamics and hence performance of tactical air defense missiles.

A variety of pressure and force wing models with varied aspect ratio, taper and airfoil sections will be tested for subsonic and low supersonic speeds in the Ames 6-by-6 foot supersonic wind tunnel and for moderate to high supersonic speeds in the Langley unitary 4-by-4 foot wind tunnel.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0006, SURVEILLANCE: EFFICIENT EXCIMER DISCHARGE LASER

D.E. Rothe, Northrop Corp., Research & Technology Center, *1 Research Park, Palos Verdes Peninsula, California* 90274 (DN875654; N00014-78-C-0831)

The objective of this work unit is to contribute to the development of a satellite mounted blue-green laser that is suitable for Navy communication and surveillance applications.

To accomplish the proposed objective, an experimental and theoretical program will be pursued to optimize power coupling into the rapidly changing load characteristics typically encountered with high pessure self-sustained gas discharges. A novel high pressure gas laser device that employs high voltage transverse electrical preionization and high impedance longitudinal electrical excitation will be designed, built, and characterized using KRF, XECL, and N2 gas mixtures. A computer model will be developed that is capable of describing the time dependent electrical and power coupling characteritic of both this device and a contractor-owned UV preionized transverse excited device. Model predictions will be compared with experimental results and optimum drive circuits for both laser devices and will be designed, fabricated, and tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0007, TRANSONIC WALL JETS

N. Malmuth, Rockwell International Corp., *Science Center, 1049 Camios Dos Rios, P.O. Box 1085, Thousand Oaks, California* 91360 (DN675217; N00014-76-C-0350)

Increased emphasis on propulsive lift devices in advanced Navy aircraft has stressed the need for an enhanced understanding of the underlying fluid dynamics processes which control the degree of force augmentation that can be achieved. The planned research will develop a methodology for predicting the flow field about an airfoil containing a transonic wall jet representative of a class of propulsive lift devices.

The interaction of the transonic wall jet with the surrounding flow will be computed for flow fields with increasing degrees of complexity. Initially a jet discharging into ambient air will be treated; viscous effects will be neglected both at the wall and at the outer slip line. Increasing complexity will be added in stages in the form of, first, an external flow and, subsequently, viscous mixing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, VERY-LOW-FREQUENCY PROBING OF THE MAGNETOSPHERE FROM SIPLE STATION, ANTARCTICA

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP76-82646 A01)

This is a continuation of NSF Grant DPP7682646. This program will involve initial winter-over operations at Siple Station, Antarctica, including tests and coordinated use of a variety of experimental equipments. Major efforts will be devoted to initial operations of the Jupiter VLF transmitter, a new system which includes previously unavailable amplitude modulation of the radiated signal. Jupiter is essentially a high-gain audio amplifier. At low power, it can operate broadband over the range 1-30kHz, instead of within the 1 kHz steps of the present system. Transmitter operations will include further investigation of the magnetospheric response to changes in transmitter power and initial studies of the response of the magnetosphere to transmission at multiple frequencies. A major objective will be continued studies of wave-induced particle precipitation so as to better determine how the observed types of precipitation events contribute on a large scale to a loss of energetic particles from the magnetosphere. An improved monitoring system will be available for handling and displaying photometric and VLF wave information on precipitation activity. Passive VLF studied of magnetospheric thermal plasma particle dynamics will continue as part of international cooperative observing campaigns, and as a source of information on magnetospheric parameters for active probing experiments. Special VLF transmissions to satellites will continue as part of in situ studies of the details of magnetospheric wave-particle interactions. Active and passive VLF probing will be carried out at Siple in support of a special rocket-balloon campaign to study wave-induced particle precipitation effects in the ionosphere and sub-ionosphere. Logistics support is required for both summer and winter-over operations at Siple Station.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

4.0009, STUDY OF COMPOUND SEMICONDUCTOR SURFACES AND INTERFACES

W.E. Spicer, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DN575032; N00014-75-C-0289)

New solid state electron devices for Navy electronic systems continue to be affected by the conditions or properties of the solid surfaces and interfaces. Improvements in techniques to

minimize these surface effects will come about as an understanding develops of the role that clean surfaces and chemical effects of impurities have on electrical properties.

The investigator will use the techniques of auger electron spectroscopy (AES), photoemission spectroscopy (PES) and low energy electron diffraction (LEED), to study various properties of the surfaces of III-V compound semiconductors. The electronic structure of the surfaces will be investigated by varying preparation techniques, i.e., ion bombardment, heat cleaning, etc. The surface chemistry resulting from oxygen obsorption will be studied with PES and LEED. The metal-semiconductor interface will be studied to understand Fermi level pinning as a function of increasing metal overlayer thickness. Attention is given to the alloying processes seen in many metal-semiconductor systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, FUNDAMENTAL RESEARCH IN SPACE

Unknown, U.S. National Aeronautics & Space Admin., Ames Research Center, *Moffett Field, California* 94035 (506-56-21)

The objective of this research is to study the feasibility of carrying out the following experiments in space. 1. Fluid Dynamics of Concentric Spheres - Feasibility of creating concentric rotating spheres in zero-g will be investigated. A modification to the JPI DDM will be designed which will accomplish the deployment of concentric spheres. 2. Velocity Relaxation of Small Particles - The feasibility of performing an experiment in space to investigate the non-Markovian aspects of Brownian motion will be studied. Necessary laser beam profiles and measurement techniques will be investigated. 3. Cryogenic Tricritical Point - An initial study will be performed to determine the feasibility of probing the region close to the intersection of 1st and 2nd order phase transitions. The experiment will require cryogenic cooling and will be performed in the vicinity of .7 Kelvin. 4. Constitutive Behavior of Granular Media - The feasibility of preparing and studying homogeneous samples of sand and other granular media in space will be investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0011, SUPERCONDUCTING WEAK LINKS FOR MIXING AT MILLIMETER-WAVE FREQUENCIES i3678-EL

T. Van Duzer, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Computer Sciences, *Berkeley, California* 94720 (DA0E9086; DAAG29 76 G0191)

To study novel schemes for detection and mixing in the millimeter and submillimeter wave range. This work will have a long range impact on millimeter and submillimeter wave programs in the army such as the beam rider guidance system, or general radar and terminal homing applications.

To investigate Josephson junctions for low noise mixing and detection in waveguide applications (below 150 GHz), test wave impedance matching arrays for submillimeter wavelengths, and continue comparison between Josephson junctions and super-Schottky metal-insulator metal characteristics.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0012, STUDIES OF NONLINEAR PHENOMENA IN HIGH-TEMPERATURE PLASMAS

P.K. Wang, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Systems Science, *405 Hilgard Ave., Los Angeles, California* 90024 (DF038270; AFOSR-79-0050)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the understanding of nonlinear phenomena occurring in high temperature plasmas and specifically the interaction of electromagnetic radiation with plasmas and the resulting instabilities. Deficiency - the aforementioned information is needed to design advanced equipment is not available to date. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this project will investigate theoretically and by computer experimentation (a) deterministic theories for plasma turbulence, (b) identification stabilization and control in high temperature plasmas, (c) plasma heating by neutral injection. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications and the development of countermeasures.

This project will perform theoretical work and computer simulation experiments in the areas: (a) Plasma turbulence. To develop a plasma turbulence theory based upon bifurcation theory. (1) Investigate the stability and interaction of three-dimensional Langmuir solitary waves. (2) Develop conditions for the existence and nonexistence of general Langmuir solitary waves. (3) Study the existence of nonlinear dynamic modes such as spikons for multidimensional langmuir waves and their interactions. (b) Plasma heating by neutral injections. Examine the problem of finding an injection current program which will maximize the peak electron or ion temperature at a given time with minimum input energy. (c) Identification, control and stabilization of high temperature plasmas. Investigate the feasibility of the global behavior controls rather than localized ones using microprocessors. At first the feedback stabilization of low-frequency MHD modes and covective instabilities will be considered. This will be followed by a meaningful small scale experiment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, SPECIALIZED RESEARCH EQUIPMENT - ACQUISITION OF A SECONDARY ION MASS SPECTROMETER

C.W. Wilmsen, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (ECS79-23982)

A secondary ion mass spectroscopy system is being purchased. The system is used for research in the surface properties of semiconductor materials.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0014, NON-LINEAR FAILURE CRITERIA AND DYNAMIC SPHERICAL SHELL RESPONSE

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DN475447; N00014-75-C-0946)

For various operating naval structural systems such as aircraft, submarines, surface ships, etc. The problem of premature fracture under normal service loads or excessive damage due to shock type loads should obviously be prevented. Fracture of materials of Navy interest as well as shock response of selected submarine components are addressed under this task.

The research efforts currently under way involve: (1) experimental evaluation of several fracture toughness parameters at the onset of subcritical crack growth and at the peak load for 4340 steel specimens of thickness 0.23 in. To 1.25 in., (2) development of a finite-element program based upon incremental theory of plasticity to analyze the crack growth process, and (3) evaluation of dynamic buckling load of spherical caps with initial imperfections or with attached center mass subjected to various kinds of pulses and the extension to include the elastic-plastic material response in the analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0015, RADIO TECHNICAL COMMISSION FOR AERONAUTICS (RTCA)
Unknown, U.S. National Aeronautics & Space Admin., *600 Independence Ave. S.W., Washington, District of Columbia* 20553 (534-04-10)

This RTOP provides for the continuation of support to the Radio Technical Commission for Aeronautics (RTCA) located in Washington, DC. The RTCA brings together experts from government, universities, and industrial establishments to advance the art and science of aeronautics through the investigation of present and potential applications of avionics and telecommunications. The RTCA and its special committees seek solutions to problems involving the application of electronics, avionics, and telecommunications to aeronautical operations; they frequently recommend technical performance standards and common operational requirements for consideration by government, industry, and aviation users. As a member of the Executive Committee, NASA's representative can present subjects or problems for discussion and action, authorize new special committees, and approve completed studies. Through the mechanism of RTCA, NASA can be kept abreast of aeronautical needs and requirements and can initiate relevant research and participate in development of solutions to common problems with other members of the aviation community.

SUPPORTED BY U.S. National Aeronautics & Space Admin.

4.0016, INTERAGENCY ADVANCED POWER GROUP SUPPORT
Unknown, U.S. National Aeronautics & Space Admin., *600 Independence Ave. S.W., Washington, District of Columbia* 20553 (506-55-70)

The objective of this RTOP is to help provide overall guidance and information for coordination, management, and planning of the space power effort. This RTOP will provide for NASA's share of operating the Power Information Center (PIC) of the Interagency Advanced Power Group (IAPG).

SUPPORTED BY U.S. National Aeronautics & Space Admin.

4.0017, VORBIX AUGMENTATION DEVELOPMENT
R.S. Reilly, United Technologies Corp., Government Products Division, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN796807; N0019-76-C-0553)

Evaluate mixed-flow augmentation improvements derived from a unique vortex burning and mixing (vorbix) concept. Specific goals include increased combustion efficiency (more than 90%) over a complete A/B fuel schedule, improvement in A/B stability, continuous A/B fuel flow modulation and significant length reduction potential.

Design and fabricate a full-scale, flight-type vorbix augmentor followed by instrumentation and operational check-out on a F401 test vehicle. Contingent on successful sea level test results, the experimental vehicle will be evaluated throughout a typical flight envelope in a NAPTC test cell with emphasis in the upper left hand corner.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0018, AIRCRAFT NONLINEAR INTERFERENCE STUDY
Unknown, Georgia Inst. of Technology, Graduate School, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF930660)

To determine the existance of low level aircraft nonavoinic nonlinear interference over the 225 MHz to 40 GHz frequency range.

An exhaustive literature search shall be accomplished to assimulate all the information relating to low level structural nonlinear interference over the 225 MHz to 40 GHz frequency range. From this date, it shall be determined whether nonavionic, nonlinear interference will be a problem or if more data must be obtained to reach a conclusion. In either case a plan needs to be developed to provide a basis for future investigations that may evolve. Work to be performed by University of South Florida.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0019, RAPID PROPAGATION OF INTERFACE FLAWS IN COMPOSITE BODIES 12791-E
J.D. Achenbach, Northwestern University, Evanston Campus, Technological Inst., Dept. of Civil Engineering, *633 Clark St., Evanston, Illinois* 60201 (DA0N5577; DAAG29-78-G-0031)

To investigate composite bodies containing flaws at the bond interfaces with a view toward finding criteria for debonding under elastodynamic conditions. Relevance: It is very important to determine impact resistance and to develop damage tolerant composites relevant to a wide range of Army aircraft and weapons development programs. An example of the latter is the welded bi-metallic rotating band in projectiles.

An analytic treatment, with emphasis on elastodynamic effects generated by the rapid propagation of interface flaws, will be used in conjunction with both energy criteria and criteria related to distributions of cohesive tractions in the vicinity of the tip of the flaw, to determine the stability or debonding of the composite.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0020, NAVIGATION - TWO-COLOR REFRACTOMETER
D.G. Currie, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN775533; N00014-77-C-0541)

The objective of this work unit is to develop a new astronomical technique which will directly measure the effects of the atmosphere on the apparent positions of stars thereby allowing the determination of stellar positions with an accuracy significantly better than 0.1 arc-second in a single observation which is of interest to the Navy for improved navigation and guidance.

This experiment involves the measurement of the apparent position of a star at two widely separated wavelengths thereby permitting one to use the difference in apparent position to determine the total effect of the atmosphere on the apparent position of stars. Data will be taken under a variety of atmospheric conditions and locations. The validity of this approach will be determined by examining the internal consistency of the data as well as comparison with the results of other measurements where atmospheric effects have been corrected in other ways.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0021, EXPERIMENTAL STUDIES OF ION CHARGE AND ION FLUX IN STREAMING PLASMAS
D.W. Koopman, University of Maryland, College Park Campus, School of Engineering, Dept. of Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (DF033820; AFOSR-76-2991)

AF function - considerable damage and incapacitation of equipment may result from laser irradiation and from a nuclear detonation. These deleterious effects may be drastically decreased and even eliminated by suitable design. Deficiency - the design characteristics of protection devices are not well known. In the case of nuclear detonations the salt agreements prohibit nuclear testing, consequently, the required data can be obtained only by simulation techniques. Objective - this research will study highly ionized plasma flows produced by laser irradiation of target materials and the interaction of these plasmas with neutral and ionized backgrounds. Three objectives may be mentioned: (a) collisional momentum transfer, (b) magnetized plasma interactions including the production of experimental data describing the expansion processes in the laser produced plasmas, and (c) comparison of the experimental and theoretical results as well as predictions, yielding improved understanding of the plasma flow dynamics. Contribution - this research is a part of a comprehensive program for the development of an x-radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and countermeasures.

This research is both theoretical and experimental, and it will investigate and elucidate the dynamics of flowing and interacting plasmas and gases with an emphasis on the processes

which transfer momentum between ion species within the flow. It will perform measurements employing the resonant optical diagnostic technique previously developed with an extension to holographic as well as schlieren and absorption recording of plasma flow patterns. In addition, it will investigate the recently discovered turbulent interaction region which is responsible for the development of shocklike momentum coupling fronts. The existing installation was modified in such a way as to add a variable magnetic field to the plasma flow region. It will thus examine flow regimes which are collisionless and will attempt to verify the mechanisms of two-stream instability which have been predicted by the theory. The optical diagnostic measurements of ion flow behavior will extend to the density range of 10 to the 20 per cubic meter by florescent optical scattering at the ion resonant wavelength. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, DEVELOPMENT OF IMPROVED MASS RATE OF FUEL FLOW TRANSMITTER FOR FUTURE NAVY AIRCRAFT

L. Lynnworth, Parametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DN881388; N62269-77-C-0363)

The general objective of this task is to further develop Navy capability to define and specify jet engine fuel system components for advanced types of Navy aircraft in the 1980 era. Future Navy aircraft, and in particular the V/STOL, will require both airframe and engine sensors that are improvements over the current state of the art. This comes about as a result of the V/STOL flight regime which is very demanding especially in the area of fuel management. With fuel management judged to be increasingly critical, and engine diagnostics a distinct possibility for V/STOL, the need exists for a fuel flow transmitter having a high degree of accuracy and day to day repeatability. This contract supports work unit ZA601, agency accession no. DN681080.

Manufacturers of this type of equipment were contacted via RFP containing a work statement embodying those requirements necessary to meet the objective.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0023, AERODYNAMIC STALL ALLEVIATION FOR SWEPT-WING PLANFORMS

R. Vangunst, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DN078815; N00167-80-C-0058)

To experimentally investigate the applicability of straight-wing stall alleviation technology by leading edge modification to a swept-wing planform. This contract is in support of DTNSRDC work unit 1606-300, reported under DN 678328.

The leading edge modification technique for increasing lift beyond stall angles of attack has been previously demonstrated in case of straightwings. In the present work, the contour of the leading edge modification will be optimized. Existing straight-wing models at the University of Michigan will be used. The optimum configuration will be applied to swept-wing planforms with sweep angles of 30 and 45 degrees. This will be accomplished by replacing a rectangular section from the leading edge of the wing with an insert having the optimized planform characteristics. The swept wing insert configuration parameters will be varied to identify areas of improvement for the swept wing planform. This study will examine the sensitivity of each major planform feature and spanwise location for its effect on the lift, drag, and pitching movement characteristics of the model. All configuration and spanwise location changes which enhance the lift and angle-of-attack characteristics of the wing will be incorporated into a final configuration. Upon completion of the program, all test results will be presented and summarized in a final report.

SUPPORTED BY U.S. Dept. of Defense, Navy, David W. Taylor Naval Ship Research & Development Center

4.0024, CONCURRENT PROCESSING SYSTEMS STUDY

T.Y. Feng, Wayne State University, School of Engineering, Dept. of Electrical & Computer Engineering, *5950 Cass Ave., Detroit, Michigan* 48202 (DF728230; F30602-76-C-0282)

The objective of this effort is to conduct exploratory development in the design and use of concurrent processing systems for Air Force data processing needs. Four broad areas of computing technology are to be emphasized, configuration systems, programming languages, modeling and performance evaluation, and design specification languages.

To investigate and develop techniques and procedures for grouping microprocessors and develop program routines which will cause these groups to act as a variety of functional units (ALU, push down stack, index register, etc.). Using the features of the data manipulator and the STARAN associative processor develop techniques for interconnecting the functional units to form concurrent computer architectures. Using the features of the NANODATA QM-1 develop specification and compiler techniques for controlling all elements of the above system such that a user's HOL description of a problem solution and an architecture specification can be entered into the system and the problem then executed as if it were on the specified architecture. Using the elements of the system, develop techniques for performance monitoring. Develop concurrent processor application programs. A solid background in parallel processor system and in the development of parallel processor algorithms is required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0025, HEAT TRANSFER AND FLOW CHARACTERISTICS IN NAVAL THERMAL CYCLES

E.R. Eckert, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mechanical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DN823027; N00014-76-C-0246)

The objective of this research is to understand and be able to predict accurately localized heat transfer and flow characteristics of working fluids in thermal systems, particularly heat exchangers and gas turbines, for the propulsion of naval ships and aircraft. This capability is particularly important in achieving higher temperatures and therefore increased thermal efficiencies and specific powers, with reliability, in Navy propulsion systems.

Theoretical and analytical techniques are sought, based upon experimental data, to understand local heat transfer and flow characteristics in gas turbines and heat exchangers. Experimental techniques utilized include laser doppler anemometry and napthaline sublimation for the measurement of flow velocities and heat transfer rates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0026, IMAGE RESTORATION VIA IDENTIFICATION OF THE BLURRING FUNCTION

B.A. Shenoi, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Electrical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (ECS79-06555)

The purpose of this research program is to investigate methods for the restoration of images that have been degraded by blurring and noise. System identification techniques are applied to obtain a general image restoration scheme which accounts for a large variety of image blurs. As part of the restoration algorithms, the blurring function is estimated based upon state space and statistical techniques. The mean square error optimality criterion is used to derive good restoration.

This research finds applications in many areas of scientific endeavor such as space and satellite photography, air reconnaissance, earth sciences, weather prediction, electronic microscopy and medical diagnosis. In addition, image processing techniques

are also applicable to non-pictorial signals found in such areas as radar, sonar and seismology.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0027, THIN FILM COMMUNICATIONS

D. MacKiernan, IMR Systems Corp., *Salem Industrial Park, Salem, New Jersey* 03079 (DN081490; N62269-79-C-0239)

To develop lightweight, low profile, highly stable communications components for integration into the helmet/mask system worn by Navy aircrewmen.

Fabricate, test and evalute microphones and earphones employing transducers of thin, polarized, polymeric films. Identify polymeric film materials offering optimum performance characteristics and design flexibility.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0028, FUELS COMBUSTION RESEARCH

I. Glassman, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (DF001830; F49620-78-C-0004)

AF function - weapons delivery, air support, airlift. Deficiency -accurate modelling of combustion and exhaust plume processes in present and future aircraft engines requires much more reliable numberical values of molecular reaction rates than are presently available. Objective - as an AFOSR center for fuels combustion research, this group will perform research leading to understanding of kinetic mechanisms and to accurate values of reaction rate constants for pyrolysis and oxidation of hydrocarbon constituents of present and alternative fuels. How work contributes - the results of these experiments are directly useful to design engineers in jet combustion and plume technology and also to scientists working on the elusive problems of combustion dynamics.

High temperature homogeneous gas-phase reaction kinetics for pyrolysis and oxidation of hydrocarbon fuel constituents in present and alternative fuels will be studied in flow reactors. The extensive concentration and temperature data obtained as functions of reaction time will be used to obtain the correct kinetic mechanisms and global rates and rate constants. Spectroscopic and mass spectroscope analysis will be used to obtain rate constants of reaction steps involving free radicals and many large product species. The mechanisms of soot formation and of carbon oxidation will also be studied in aliphatic and aromatic systems. A theoretical effort will be devoted to developing,and applying Green's function method for efficiently and comprehensively performing kinetic sensitivity analysis of the resulting mechanisms and other equational systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, THE STABILITY, ELECTRONIC AND SURFACE PROPERTIES OF THE ALKALI AZIDES 13778-C

B.S. Royce, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Engineering, *Box 430, Princeton, New Jersey* 08540 (DA0E9167; DAAG29 76 C 0054)

This proposal is concerned with the continuation and extension of experimental measurements of the thermal and optical decomposition of potassium and rubidium azide in order to elucidate the solid state reactions processes involved. This research should provide much needed information on a class of metastable materials such as explosives, pyrotechnic ingredients, and propellant composition components.

The study will focus on the early stages of decomposition of both powder and oriented single crystal specimens in ultra high vacuum or controlled gas ambients. Techniques to be employed include the scanning electron microscope, the photoacoustic technique, photoluminescence, and mass spectrographic detection of decomposition products.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0030, A THREE DIMENSIONAL STUDY OF INDUCED SHOCK WAVE TURBULENT BOUNDARY LAYER INTERACTIONS - 14026-E

I.E. Vas, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Engineering, *Box 430, Princeton, New Jersey* 08540 (DA0E9174; DAAG29-78-G-0140)

To more thoroughly investigate the scale of the ineraction between a shock wave from a sharp leading edge generator and a turbulent boundary layer on a flat plate by changing the boundary layer thickness using unswept and swept leading edge flat plates. The research is relevant to activities at BRL and other Army laboratories concerned with designing fin stabilized anti-tank projectiles and fin stabilized long range missiles.

An experimental study will be conducted in the Mach 3-high Reynolds number supersonic facility of the contractor by examining l-scale effects of the boundary layer in the interaction region and measuring heat transfer for a thin boundary layer configuration.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0031, 1.3 UM LEDS FIBER OPTICS

C. Neuse, RCA Corp., RCA Laboratories, *Washington Rd., Princeton, New Jersey* 08540 (DF905660; F19628-79-C-0115)

To develop high radiance high speed LED's for 1.1-1.3 micron operation with improved fiber coupling capability. This program is designed to develop new heterojunction technology for improved LED efficiences and advance Air Force optical communications systems. TPO effort title - Optical Device and Signal Processing Technology.

The contractor shall conduct a research program to design and fabricate LED's for 1.1-1.3 micron operation. Vapor phase epitaxy will be used for growing appropriate 111-V compound heterojunction structures. The research should be directed at improving the quantum efficiency beyond the one half to one percent of the current, homojunction devices. High-radiance configurations employing both edge and Burrus type emission are to be investigated with the goal of coupling 1NW power into low-loss fibers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0032, AUDIO AVIONICS CONTROL/STATUS SYSTEM

L.A. Sorenson, Semcor Inc., *1500 N. Kings Hwy., Cherry Hill, New Jersey* 08034 (DN081138; N62269-79-C-0009)

Generation of a functional configuration governing the implementation of an audio avionics control and status system. The configuration is to define an overall aircraft avionics system which will enable the implementation of voice recognition and synthesis equipment as part of the overall avionics system configuration. This contracted effort supports work unit ZC101, agency accession DN 081123.

Study and analyze modern day avionics system implementation multiplex data BUS control status audio signals and trends, then couple this with present and future VRAS technology projections for generation of a configuration which will allow for the incorporation of such technology VRAS when available.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0033, ROTOR HEAT TRANSFER

M.G. Dunn, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF464430; F33615-79-C-2075)

Measure the heat transfer to a full turbine stage using a shock tube as the hot gas source.

Fabricate the test section and instrumentation designed under a previous program and perform verification of technique testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0034, KINETIC THEORY OF GASES AND MAGNETO-FLUID DYNAMICS AND THEIR APPLICATIONS

H. Grad, New York University, Washington Square & University College of Arts & Sciences, Dept. of Mathematics, *421 1st Ave., New York, New York* 10012 (DF041250; AFOSR-76-2881)

AF function - hardening aerospace vehicles. Opportunity - existing mathematical physics promises improved understanding of satellite environmental effects and their simulation. Objective - to address plasma stability problems in Shiva, laser hardening, solar wind prediction, satellite charge oscillations, ionospheric modeling, etc. How work contributes - improved analysis of models designed to exhibit AF relevant effects may suggest methods of control.

At the borderline between particle and fluid, when charge, EM field and energy range combine to make nonlinear mathematical models necessary, a diversity of mathematical techniques is required. Examples are singular perturbation of spectra, bifurcation theory, pseudo differential operators, solitions, etc. Using these techniques, problems like the instabilities possibly limiting Shiva x-ray output, solar wind modeling and laser target interactions can be addressed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS

W.A. Anderson, State University of New York, Buffalo Campus, School of Engineering & Applied Science, Dept. of Electrical Engineering, *3435 Main St., Buffalo, New York* 14214 (150-6289A; AC03-79ET23044)

This project is designed to ultimately produce a low-cost thin film silicon solar cell. A MIS design is selected rather than the conventional P-N junction. Electron beam deposited silicon will be used as the initial stage of a high-speed, low-cost production process. The first year of work is designed to show feasibility of this approach. Several objectives have been set for this research project. Fabrication studies are planned on single crystal and polycrystalline silicon slices (250 mu-m thick) to achieve efficiency values of 14% and 12%, respectively, for MIS device having areas more than 2 sq cm. Further analysis of these devices will include conduction mechanisms and modelling, surface state analysis, and environmental testing. Thin silicon films (20 to 30 mu-m) will be deposited on heated metal substrates using electron beam and induction heating techniques. These films will be evaluated using SEM, X-Ray, TEM, Auger, and SIMS studies. MIS devices will be used to evaluate conduction mechanisms and grain boundary effects.

SUPPORTED BY U.S. Dept. of Energy, San Francisco Operations Office

4.0036, PRIME FOCUS FEEDS FOR PARABOLIC ANTENNAS

R.E. Collin, Case Western Reserve University, School of Engineering, Dept. of Electrical Engineering & Applied Physics, *University Cir., Cleveland, Ohio* 44106 (ECS79-10269)

The objective is to investigate coaxial type prime focus feeds in order to optimize these feeds for use in low cost satellite earth station antennas. Initially the mode coupling coefficients between 2, 3, and 4 semi-infinite coaxial circular waveguides will be determined. This information will then be used to design optimum coaxial feeds as determined by a study of the required feed aperture field distribution and resultant radiation pattern. The performance of the optimized feeds will be measured experimentally. An optimum feed for use with a four foot paraboloid will then be designed and its performance measured. The effect of the feed support structure on the sidelobe level will also be investigated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0037, ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATION

T. Compton, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DN890051; N00019-79-C-0291)

The objective of this program is to investigate techniques for using adaptive antenna concepts appropriate for use in conventional airborne military communications systems to reduce or eliminate signal interference.

The research study on adaptive antennas will include (1) a study of the weight jitter and dynamic range properties of a new adaptive array feedback loop that will have convergence time constants independent of the signal power, (2) concepts for the application of adaptive techniques for frequency shift keyed signals and (3) preparation of a monograph on adaptive arrays.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0038, INVESTIGATION OF CHARGED WALLS IN MAGNETIC BUBBLE DOMAIN DEVICES

M.H. Kryder, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Electrical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (ECS79-12677)

This program provides an investigation of charged walls in magnetic layers with in-plane anisotropy and an exploration of novel device concepts based on the charged walls. The behavior of the walls in device structures is investigated via microscope observations aided by use of Ferrofluid and the magneto-optic effect. Physical properties of the layers are investigated using Ferromagnetic resonance, while Lorentz microscopy and a high resolution magneto-optic photometer system is used to directly determine the magnetization configuration in and around charged walls in devices. The dynamic properties of the charged walls is examined with a high resolution photometer system so that a direct determination of the charged wall dynamic properties can be made without the complicating influence of a bubble domain coupled to it. Among the novel device concepts to be explored are the use of amorphous films with appropriate magnetic properties as a substitute for ion-implanted garnet layers, and alternative garnet layers which could offer improved performance relative to the layers presently being used.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0039, LOW DRAG AIRFOIL DESIGN UTILIZING PASSIVE LAMINAR FLOW AND COUPLED DIFFUSION CONTROL TECHNIQUES

R. Mask, Advanced Technology Center Inc., *P.O. Box 6144, Dallas, Texas* 75222 (DN881476; N62269-77-C-0442)

To design a low drag airfoil utilizing passive laminar flow and coupled diffusion control techniques to obtain improved lift to drag ratios for advanced subsonic aircraft applications. This contract supports work unit NN701 agency accession no. DN 481077.

2D airfoil will be designed with the front part contoured to maintain laminar flow, ATC at 80 per cent upper surface and Stratford diffusion contour at lower rear surface. Design transition 80 per cent upper and 70 per cent lower. The design will be tested in an air boundary layer channel, and the NASA Ames transonic wind tunnel.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0040, SUPERSONIC WAVE DRAG PREDICTION
R. Stancil, Vought Corp., Flight Technologies Division, *P.O. Box 5907, Dallas, Texas* 75222 (DN879006; N00167-78-C-0005)

To derive improved techniques for predicting supersonic wave drag on generalized aircraft configurations. This contract is in support of DTNSRDC work unit 1600-078, reported under DN778004.

Apply the modified linear theory method (developed by the con-tractor)to overcome limitations of current supersonic area rule method. The modified linear theory calculation will be programmed into a non-axisymmetric body computer routine with an input geometry definition sub-routine. A graphics geometry editing routine will also be incorporated. Prepare and verify program. Furnish program decks, user's manual and user training.

SUPPORTED BY U.S. Dept. of Defense, Naval Ship Research & Development Center, Aviation & Surface Effects Dept.

4.0041, ADVANCED HIGH PERFORMANCE VEHICLE SYSTEM STUDIES
Unknown, U.S. National Aeronautics & Space Admin., Langley Research Center, *Hampton, Virginia* 23665 (530-03-13)

The technical objective of this work is to identify aerodynamic, propulsion, and structural technology areas significant to the development of future generations of military systems including missiles and aircraft. In close coordination with DOD, one or more technology studies will be conducted to evaluate alternative vehicle and system concepts, and build an information base for research program planning in support of future military aviation and missile systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0042, RESEARCH ON TEST RANGE INSTRUMENTATION FOR MISSILES AND ROCKETS 14855-A-E
K.M. Pell, University of Wyoming, School of Engineering, Dept. of Mechanical Engineering, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DA0F8944; DAAG29 77 G0090)

To develop analytical models for processing data obtained from a remote laser attitude sensing system for missiles, to investigate remote attitude determination techniques applicable to non-rolling or slowly rolling missiles and to investigate pressure measurement techniques adaptable to range instrumentation. Relevance: Data required in research and development testing of tactical weapon systems includes the rapid determination of vehicle position and attitude as a function of time this research directly addresses this requirement and is strongly relevant to the missile test range instrumentation requirements at the Army Missile Command.

Alternative mathematical formulations for the attitude sensing system reflecting missile dynamic conditions, sensitivity and relative position, and efficient solution algorithms will be performed. Different on-board reflector configurations will be investigated for use on slowly rolling vehicles and system concepts applicable to on-board pressure measurements will be defined.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0043, INVESTIGATION OF PLASMA INSTABILITIES
F.F. Cap, (No Performing Organization Reported), *Austria* (DF039940; F44620-75-C-0006)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, both laser and beam weapons, space and ionospheric communications and countermeasures demand design data which can only be obtained from fundamental understanding of high temperature plasmas. Deficiency -present day understanding of high temperature plasma, such as non-linear effects, e.g., waves and instabilities is incapable to satisfy the aforementioned requirements. Objective - this research is aimed toward understanding and exploiting the unsteady aspects of plasma behavior such as instabilities and waves. Contribution - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of countermeasures.

One goal of this effort is the preparation of the third volume of the engineer's handbook on plasma instabilities. This will incorporate the existing important theoretical and experimental results plus an extensive bibliography of the state-of-the-art reports on plasma instabilities. In addition, research will be continued to experimentally verify earlier theories on nonlinear saturation of instabilities and nonlinear parametric effects. The topic of instabilities will be investigated both theoretically and experimentally in the Q-machine, in the context of plasma heating by relativistic electron beams, laser heating of plasmas and beam plasma instabilities. In addition coupling of nonlinear and inhomogeneity effects will be examined. Again feedback and dynamic methods of stabilization of instabilities will be studied. special topics connected with ionospheric and space plasmas also will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0044, NEW PASSIVATION METHODS OF GaAs
H.L. Hartnagel, University of Newcastle Upon Tyne, Merz Lab., Dept. of Electrical & Electronic Engineering, *6 Kensington Terr., Newcastle Upon Tyne, England, United Kingdom* (DA0D9303; DAERO 78 G0103)

Passivation of GaAs and INP surfaces is essential for many device structures. One important requirement is to produce a GaAs MOSFET. promising preliminary results have been achieved in work under a previous grant, and further progress to obtain normally-off microwave MOSFETS with good transconductances should be possible. Such GaAs MOSFETS will allow considerable improvements of very high speed integrated circuits for military applications.

The electrolytic process of anodic oxidation will be further improved and new oxide compositions will be investigated to obtain stable amorphous oxides up to 600 degrees C and above. Investigation methods will include electron and x-ray diffraction, auger analysis with ion etching, and Rutherford scattering. In collaboration with the U.S. Army Electronics Command, oxide films of various types will be supplied for application of the high pressure facilities at ECOM for possible improvements of the native oxides. In connection with this collaboration, work on the oxidation of INP will be continued.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0045, SCANNING TRANSMISSION ELECTRON MICROSCOPY OF ELECTROMAGNETIC STRUCTURES
R.S. Tebble, University of Salford, *The Crescent, Salford, England, United Kingdom* (DF041860; AFOSR-76-2896)

AF function - advances in command, control and communications depend directly upon the reliability and performance of electromagnetic devices which are in large measure dependent upon the solid state electromagnetic materials of special and unique properties and behavior. Opportunity - newly developed instrumentation in England provide a timely opportunity to investigate the electronic and magnetic structures and phases as well as the crystallographic features, defects and interfaces of a variety of materials used and needed in solid state electromagnetic devices. Objective - the determination of segregation effects at interfaces in junction devices, defects and impurities in semiconductor compounds such as Si, GaAs, GaP, INP, PBTe and ZnSe is the aim of this research. Doped silicon is of special interest not only as an established solid state device material but is of particular interest in its amorphous form. The effects of ion-implantation with suitable elements such as phosphorus are being studied. Amorphous silicon and alloys such as GdCo and Fe-Ni-(P,C,Si) are also being investigated. How work contributes-these investigations should result in a more precise resolution of impurities defects and stacking faults in the solid state materials used in electromagnetic devices and should therefore lead to a better and improved materials technology for electromagnetic devices.

Novel techniques of selected area scanning transmission electron microscopy, high-voltage, high-resolution conventional transmission electron microscopy and selected area electron and x-ray diffraction analyses are being applied to the determination of crystallographic, topographic and morphologic features of electromagnetic materials of technological interest.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, COMPUTER MODELING OF MOLECULAR SPECTRA FOR AURORAL STUDIES

V. Degen, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM79-18790)

This grant funds auroral studies in which molecular spectra are modeled on a computer for comparison with observed data. The emphasis of this research program will be on improving and updating the current theoretical formulation of the molecular intensity band profiles. Specifically, (1) a previously developed formulation for the N2 ion First Negative System excited by electron impact at arbitrary vibrational and rotational temperatures will be incorporated in existing computer codes for the N2 ion Meinel, N2 Second positive, and other band systems; (2) recently uncovered discrepancies in the N2 First positive band profiles will be examined in terms of more general rotational selection rules and cross sections in the electron impact excitation channel than are currently employed. Both aspects have general applicability in auroal spectral modeling.

The study is aimed, in part, at providing quantitative band profiles for high latitude dayside cusp spectra, for which modeling at elevated temperatures is appropriate. Such observations are carried out with the Geophysical Institute spectrometer facility currently located at Spitsbergen under another NSF-sponsored program.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0002, SUPPORT SERVICES FOR USERS OF THE CHATANIKA INCOHERENT SCATTER RADAR DURING THE IMS PERIOD

R.D. Hunsucker, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-21460)

This grant funds Geophysical Institute personnel to provide operation, maintenance data collection, and some data reduction for instrumentation used in support of Chatanika incoherent scatter radar operations by users other than the University of Alaska during the IMS. The Geophysical Institute will endeavor to obtain good quality data, prepare copies of the data, and disseminate the data to Chatanika radar users by specific request. It will also provide technical assistance in operation of other support instrumentation provided by radar experimenters, as well as limited assistance in Chatanika radar operations. This will lead to a more fruitful net IMS effort than would be otherwise possible.

The Chatanika Incoherent Scatter radar near College, Alaska, provides a unique set of high-latitude time continuous profiles of charged particle temperatures and concentrations, neutral winds, electric fields and energy deposition rates: parameters leading to better understanding of upper atmospheric physical processes. Research scientists from over a dozen U.S. and foreign institutions travel to Chatanika each year to pursue their research efforts, and this pressure is enhanced during the present years of the International Magnetospheric Study. The efforts by the PI supported by this grant provide a more meaningful context of geophysical data within which this overall effort will now take place.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0003, EXPERIMENTAL AND THEORETICAL RESEARCH ON THE AURORA BOREALIS

M.H. Rees, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM79-23266)

This grant supports an integrated approach that combines modeling and observations to investigate the atmospheric consequences of the aurora borealis. It is the goal of the simulation studies to provide a quantitative description of a wide range of effects that attend auroral particle precipitation and electric fields. A new theoretical formulation of electron transport in the atmosphere will be incorporated in the existing time-dependent auroral model. A convergent magnetic field will be adopted in order to study conjugate auroral phenomena. It is planned to include explicitly an electric field parallel to the magnetic field, while retaining elastic and inelastic collisions. Spectrophotometric observations of the aurora, to be obtained initially in the polar cusp region, will be used to test the models as well as provide inputs to the computations. Available satellite, rocket, and ground-based radar data will be used to test whether the model correctly predicts the observable chemical, dynamic and thermal atmospheric response to measured auroral particle and field inputs.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0004, SPECTRAL DEPENDENCY AND POLARIZATION OF LIGHT SCATTERED BY ATMOSPHERIC ICE CRYSTALS

G.G. Sivjee, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-17511)

Ice clouds play an important role in the atmospheric radiative transfer and in the interpretation of satellite data. This is especially important in the polar regions and high altitudes where ice crystals are a common constituent of the atmosphere. Therefore, it is essential that the scattering and absorption properties of ice crystals be properly formulated and not approximated from ellipsoidal particles. Because of the inherent complexity of a mathematical formulation, we propose to conduct a field experiment to determine the effect of atmospheric ice crystals on the scattering of light in the visible and near-infrared. The presence of three distinct types of ice crystal phenomena at ground level around Fairbanks (single ice crystals of a particular habit precipitate for periods of a day to a week) and the successful development of precision spectrophotometers capable of operating under extreme low temperatures, have eliminated to a large extent the limitation imposed on field experiments to determine scattering properties of ice crystals. With these experiments the scattering of light by ice crystals, falling with a preferred orientation in the atmosphere, will be determined. The results will express the scattered irradiance per unit volume per unit steradian as a function of wavelength, scattering angle, orientation of the scattering plane to the vertical, and the concentration and size distribution of the ice crystals.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0005, VERY-LOW-FREQUENCY PROBING OF THE MAGNETOSPHERE FROM VOSTOK STATION, ANTARCTICA

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP78-18316)

The Stanford University Very-Low-Frequency Group will provide a Winter-Over Exchange Scientist at the USSR station

at Vostok, Antarctica. While at Vostok, the U.S. Exchange Scientist will operate VLF, micropulsation, riometer, and electric field instruments for several U.S. programs there.

Logistic support is required to transport the U.S. Exchange Scientist and his equipment and supplies to Vostok Station during the austral summers.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0006, OCEAN RESEARCH SUPPORT ACTIVITIES

Unknown, U.S. National Aeronautics & Space Admin., Jet Propulsion Lab., *4800 Oak Grove Dr., Pasadena, California* 91103 (146-40-01)

The GRAVSAT and TOPEX have a commonality of purpose, in that definition and understanding of the geoid is a key ingredient of both. It is agreed that knowledge of the geoid, such as that to be determined by GRAVSAT, is necessary for full and correct interpretation of TOPEX satellite altimetry. And, in addition, a geoid determined by GRAVSAT can be augmented by the short-wavelength information derived by TOPEX. Objectives of the study, then are to: (1) assess the ability of GRAVSAT to satisfy the ocean geoid requirements of TOPEX, and (2) determine whether or not the scientific commonality is such that a combined program is feasible, desirable, and justifiable on the basis of data quality, implementation and management considerations, and total program costs. Consistent with the letter of December, 1979, from A. Calio to the Directors of GSFC, JPL, and WFC, JPL will lead this study, working closely with NASA/ER and GSFC, and report to NASA/EB. The study will run concurrently with the separate TOPEX and GRAVSAT studies at JPL and GSFC, respectively. The major task elements within the study are: (1) geophysical product documentation; (2) technology readiness assessment; and (3) performance prediction assessment.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Jet Propulsion Lab.

5.0007, MONEX BROAD SCALE RADIATION BUDGET COMPONENTS

S.K. Cox, Colorado State University, School of Science, Dept. of Atmospheric Sciences, *Fort Collins, Colorado* 80523 (ATM80-10691)

The general goals of this research program are to gain an understanding of the components which determine the atmospheric radiation budget of the Asian summer monsoon. Atmospheric radiation and microphysics data will be analyzed in conjunction with meteorological satellite data to study the radiative properties of upper tropospheric clouds, aerosols, and characteristic regimens of vegetative cover, soils and topography. In addition, the angular characteristics of reflected solar energy from cloud fields will be studied. The data were collected by the PI and his colleagues during the field phase of the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program which took place during the Spring and Summer of 1979. A large part of the data were taken from the NASA CV-990 research aircraft.

The most ambitious part of this program is the production of atmospheric and surface radiation budgets following the 1979 summer monsoon onset. In addition, some regional budgets will be generated as an independent check on the large scale budgets. These budgets will be correlated with meteorological events and with physical changes in the surface-boundary layer regimes.

The heat sources and sinks of the Asian monsoon provide the initial forcing of that important weather and climate phenomenon. This study is intended to provide a clearer understanding of that forcing.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0008, ANALYTICAL CLOUD PHYSICS

W.A. Hoppel, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480215)

Provide new and improved capabilities to the Navy in overcoming operational difficulties caused by hazardous environmental conditions and in using the environment to an advantage. Achieve a better understanding of cloud and fog dynamics, nucleation, glaciation, condensation, atmospheric electrification, pollution, atmospheric radioactivity, and atmospheric particulates.

Perform interrelated laboratory, field, and modeling experiments and develop the theoretical tools necessary to explain and predict the observed results. Field experiments include the use of aircraft, ships, and ground field sites as platforms for data acquisition. The data acquired from laboratory and field investigations are analyzed and compared to the predictions of current theoretical models with the aim of improving these models and our understanding of atmospheric physics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0009, SOLAR-TERRESTRIAL PHYSICS

D.J. Michels, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880036)

To improve basic understanding of the relationships between geophysical disturbances and the variability of solar plasma and electromagnetic radiations. Improved understanding of the mechanisms that cause disturbances in the Earth's magnetic field and the ability to characterize and predict the occurence and severity of such disturbances (geomagnetic storms) is of great importance to the Navy. Essential Navy/DOD systems are affected by geomagnetic anomalies in some cases geomagnetic activity ranks high among causes of system outage or degradation or as a significant cause of false signatures.

Research emphasis will be on improved understanding of how the solar material is propagated towards earth and on understanding what parameters govern the severity of the geomagnetic response. Solar monitoring experiments will be flown in satellites collaborative arrangements will be worked out to achieve the multidisciplinary approach required by this problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0010, PROFILE OF ENERGETIC IONS IN THE ATMOSPHERE

R. Silberberg, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN580199)

To determine the heavy-particle radiation spectrum, especially for highly ionizing nuclei, at different levels within the upper atmosphere, and to apply the data on these penetrating particles in estimating their potential hazards to high altitude missions.

A computer code will be developed to transport the heavy particle radiations through the magnetosphere and into the atmosphere in successive steps, until the particles come to rest or are lost through nuclear interactions. Existing data on energy spectra, composition, geomagnetic effects, energy loss, and nuclear transformations will be utilized. Experiments will be carried out to supplement the limited data that now exist on fragmentation of heavy nuclei in air. The goal of this project---the assessment of heavy-particle radiation effects---involves application of the results to an operational system, such as high-altitude aircraft and its crew.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0011, TRANSIENT SCATTERING BY HYDROMETEORS

J.J. Stephens, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (ATM77-07758)

The objective of this research is the theoretical and computational examination of scattering of electromagnetic waves in the presence of various hydrometeors, mostly drops of ice and water. Though the complete solution for a sphere is available, its complexity thwarts a ready physical understanding of the diffraction process. It has been demonstrated by others that if the incident radiation is approximated by a (normalized) delta function then the scattered field of illumination is the impulse response. The latter description permits the isolation of several field contributions stemming from different interactions. This, in turn, permits a more direct physical interpretation than is otherwise possible. The primary application of these results is to the scattering signatures produced by meteorological radar.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0012, THE MARINE ORGANIC GEOCHEMISTRY OF STABLE HYDROGEN ISOTOPES

W.M. Sackett, State University System of Florida, University of South Florida, School of Natural Sciences, Dept. of Marine Science, *4202 Fowler Ave., Tampa, Florida* 33620 (OCE80-02455)

The study of the behavior of the stable isotopes of carbon, oxygen and hydrogen in organic matter has given us an understanding of the origin and evolution of organic material in meteorites, the earth, and the oceans. Although much has been accomplished, much still remains to be done. This is particularly true in the area of the organic geochemistry of hydrogen isotopes.

This research will focus on the behavior of stable hydrogen isotopes associated with organic matter and its degradation products in the marine environment. A major objective of this research is the determination of the fractionation which takes place during transformation reactions. By obtaining data on the fractionation process, it will be possible to establish which compounds retain information about their sources and which compounds are indicators of changes in post-depositional environments.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Ocean Sciences

5.0013, STUDIES OF IONOSPHERIC SCINTILLATION PROBLEMS

C.H. Liu, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (ATM77-22485)

Recent coordinated observations have now provided a sufficiently meaningful data base defining the equatorial ionospheric irregularities that quantitative modeling is possible. One of the most striking results is the Jicamarca incoherent scatter observation of plume like structures which now have led many to view the instabilities as due to instabilities associated with upwelling of depleted plasma density regions (bubbles) from the lower F regions. Radar, in situ, and scintillation data provide a broad spectral picture of the phenomenon.

This grant will fund the processing and analysis of this data with emphasis on the possible link to the phenomenon of rising bubbles. Preliminary calculations for the satellite transmission data base have shown one a priori viable hypothesis, ducting in the field aligned bubbles, to be unlikely; while another hypothesis, multi-path type refractive scattering at the extreme sharp density gradients at the 'walls' of the bubbles, appears feasible. This will be examined in detail. It has been suggested that a hierarchy of instabilities may be operative during equatorial spread F to produce the full wave number spectrum of irregularities. The modeling will test scintillation dependence for a multi-frequency (amplitude and phase) data base.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0014, GROUND DATA PROCESSING TECHNOLOGY OPTIONS ASSESSMENT FOR MISSIONS OF THE 1985-1990 TIME FRAME

Unknown, U.S. National Aeronautics & Space Admin., Goddard Space Flight Center, *Greenbelt, Maryland* 20771 (540-01-16)

Previous history in NASA research and development and operational missions has shown that these systems were designed from space looking down, i.e., design a space sensor that produces data, get these data to the experimenters/users, and finally, attack the problem of translating these data to the information products required. This RTOP will lead to a ground-up design process for new missions of the 1985-1990 time frame, i.e., define the information products that are required and then design the space and ground data/information delivery system to obtain and produce the data/information necessary to derive the final information products. New technological approaches and techniques to efficiently perform the data to information conversion and data dissemination will be identified.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0015, RESEARCH APPLICATIONS OF OCEAN DATA IN LARGE-SCALE FORECASTING MODELS

Unknown, U.S. National Aeronautics & Space Admin., Goddard Space Flight Center, *Greenbelt, Maryland* 20771 (146-40-17)

This RTOP aims to provide theoretical support for the application of satellite observations of ocean-atmosphere integrations. The principal applications are: (1) the assimilation of surface wind and temperature data into numerical weather prediction (NWP) models, and the determination of their impact on short-term forecasts; (2) the prediction of upper ocean currents, temperatures, sea state, mixed-layer depths and upwelling zones; (3) the interactions of the atmospheric and oceanic circulation systems on time scales of a month or more. This program specifically includes ocean modeling and is designed to support extended-range forecasting and climate studies which depend on ocean-air interactions. Experiences gained in extracting and utilizing meteorological information from satellite-derived data over the past 6 years has provided Goddard Modeling and Simulation Facility (GMSF) with a unique capability. The Laboratory for Atmospheric Sciences (GLAS) general circulation model (GCM) has been a crucial component of this previous work. The above application of SEASAT data requires a similar model for prediction the ocean-atmosphere interactions. Our plan calls for coupling the GCM with models of the upper ocean circulation, as well as further development of ocean models.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0016, CRUSTAL MAGNETIC FIELD REPRESENTATION AND VERIFICATION

Unknown, U.S. National Aeronautics & Space Admin., Goddard Space Flight Center, *Greenbelt, Maryland* 20771 (677-45-06)

Recent research with anomaly data from the POGO satellites has been very fruitful but has also raised some questions. These questions have to do with isolation of the true anomaly field in the presence of contaminating fields and of unmodeled gravity field components in the orbit determination of satellite measuring of the magnetic field and with mathematical representation of the crustal anomaly field. The objective of this RTOP is to develop and apply techniques for isolating, mapping and representing the true magnetic field at satellite altitude due to crustal sources. Isolation of anomaly fields from external fields will be pursued in two ways: visual techniques utilized for the high latitude POGO data will be applied to low latitude data and Wiener filtering techniques shown feasible in a pilot study will be extended and tested further. Development will begin on computerized mathematical technique for reduction of satellite anomaly data to its equivalent when there is a common inclination of the ambient field. Simulations will be devised and carried out to investigate the effect of gravity anomalies on measurement of magnetic anomalies. This RTOP supports the

non-renewable program which in turn supports the end objectives of resources assessment.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0017, ATMOSPHERIC DENSITY MODELS INCLUDING TIDES

J.M. Forbes, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF246720; F19628-79-C-0088)

AF function - orbital navigation, orbital surveillance. Deficiency - ephemerides of operational satellites cannot be computed accurately due to lack of knowledge of spatial and time variations of density at critical altitudes. Objective - development of improved models of the thermosphere including the effects of tides and test and evaluation of model atmospheres for use by COESA and Air Force operational organizations. How research contributes - new models, which will include work done on this contract, can be recommended for use by the NORAD Cheyenne Mountain Space Computation Center and by COESA in the development of revised U.S. standard supplements.

A multiple linear regression (MLR) model of the thermosphere will be compared with an independent set of observations, the JACCHIA (1977) empirical model and the MSIS model. A complete hybrid observational-theoretical wind model will be developed for consideration by COESA. Evaluation of the MLR model's ephemeris prediction capability will be made using data from Doppler beacon, OV1-17, OV1-21 and more recent satellites. Appropriate recommendations concerning the new models will be made to COESA and ADCOM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, TIROS-N MICROWAVE SOUNDING UNIT

D. Staelin, Massachusetts Inst. of Technology, Research Lab. of Electronics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (9-115; 04-8-MO1-1 MOD. #2)

OBJECTIVE: To investigate and solve many of the identifiable problems associated with the use of microwave technology on the TIROS-N Microwave Sounding Unit. These include: (1) questions relevant to the functional specifications for the next-generation passive microwave sounders, (2) studies most relevant to current operational problems, which include the deleterious effects of inappropriate statistics, rain, surface properties, and possible instrument variations, (3) studies directed toward long-range improvements, such as Kalman retrieval systems incorporating circulation models.

APPROACH: A software package for processing the TIROS-N data at the grantee institution will be developed. This will enable experiments to be performed for evaluating the sensitivity of retrievals to such parameters. The software will be used in the solutions of the several known problems as they affect microwave soundings in general. Also, the verification and study of the MSU performance will be accomplished by comparison with ground truth data and various physical models. Finally, studies will be conducted with the software processing package and theory to develop specifications for future microwave sounders.

PROGRESS: The software package for processing the TIROS-N MSU data has been completed. MSU data for periods in February and July, 1979, have been analyzed and have been compared and correlated with NMC objective analyses. Two retrieval systems are essentially complete; one is a conventional linear statistical procedure and the other one is a Kalman filter technique.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0019, COMPOSITION AND CARBON-14 CONTENT OF GAS IN ICE AT THE ANTARCTIC METEORITE SITES

E.L. Fireman, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DPP78-05730)

Meteorites have been found in the ice at the edges of the antarctic ice sheet in recent years. These meteorites fell on the ice sheet tens of thousands of years ago and are now exposed in areas where the ice is being lost by melting and sublimation. The history of these meteorites may be deduced by their interrelationship with the ice. This proposed project will analyze gas in ice samples collected at the antarctic sites where the meteorites are found. The N2, O2, Ar, and CO2 contents, isotopic compositions, and the carbon-14 radioactivity will be measured. The combination of the age and composition of the gas in the ice with the fall times of the collected meteorites is a new source of information for glaciology, atmospherics, and meteoritics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0020, IONOSPHERIC REFRACTION FOR DEEP SPACE SURVEILLANCE RADARS

R.S. Allen, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580880)

AF function - advanced radar and navigation systems. Deficiency -the sensitivity of ground based and satellite radars which detect and track deep space targets is severely limited by ionospheric effects. The normal variability of the ionosphere causes target signal phase to vary so rapidly that present and proposed radars can only integrate coherently for small samples of 10 to 100 seconds. Objective - develop a technology to support ADCOM requirements for deep space systems, tailored to the range extension modification of SPADATS radars and to the deep space surveillance radar system. How research contributes -increases the sensitivity of radar detection and tracking in deep space so that trade offs can be made between system performance and costs. Provides a technique to use local measurements of changes in the ionosphere so that AWS predictions of median ionospheric conditions can be adapted to the real time conditions in the attack corridors. This will make the range extension feasible at existing ADCOM radars. Provides design and development technology for the follow on deep space surveillance systems for use in preliminary design and system development. Investigate time rate of change of ionospheric refractive effects for deep space surveillance systems, using existing AFGL models of electron density profiles and of ionospheric parameters. Develop and validate computer algorithms so that the air weather service can provide a monthly median prediction of refractive effects for deep space radars. Develop adaptive techniques to use real time local radar and ionospheric measurements to correct for the hour to hour variability of the ionosphere. Determine the optimum grid of local observations and the optimum interval between updates to meet the performance requirements over the system field of view.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, SPACE VEHICLE CHARGE EJECTION STUDIES

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AF function - communications, satellite survivability and surveillance. Deficiency - inadequate knowledge of the effects of charged particle ejection systems on space vehicles in the upper atmosphere. Objective - to study and determine Air Force applications of rocket and satellite-borne charged particle ejection systems. How research contributes - the research will determine both the advantages and disadvantages of Air Force applications of charged particle ejection systems on space vehicles.

A sounding rocket payload will be designed, built, tested, and flown to achieve the objectives of measuring spacecraft charging during beam ejection, determining limitations of using unneutralized beams, and investigating techniques and problems of high energy charge particle ejection and beam-ambient plasma interactions. Charge particle ejection sources will be used to eject charged particles both positive and negative with a

wide dynamic range of current, mass, energy and injection period. For the purpose of investigating spacecraft charging during the rocket payload flight measurements will be made of beam characteristics, vehicle charging, the shape and structure of sheaths, and changes in return current characteristics. Measurements will also be made of the important ambient and vehicle parameters such as ion and electron density and temperature before and during charge ejection, the neutral density and characteristics of the ambient near the vehicle, and vehicle pitch and aspect angles. The data will also be compared to theory for validation and extension of models used to explain and predict beam ejection effects on space vehicles and the atmosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, SCATHA ENVIRONMENTAL ATLAS
H.B. Garrett, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583240)

AF function - AF communications satellites at synchronous orbit are degraded by satellite charging induced by the plasma environment. Deficiency - the space environment during periods of satellite charging is not sufficiently defined. Objective - comprehensive specification of the geosynchronous electron and ion population. How research contributes - plasma data from the SCATHA satellite will be used to supplement the AFGL geosynchronous plasma atlas allowing a complete specification of the geosynchronous orbit environment. The specification will aid in the understanding of the spacecraft charging phenomenon which is necessary so that steps may be taken to prevent damage to satellites from electrostatic discharges (ESD). This work supports a MIL standard which contributes to operational capabilities of AF satellites.

Data from the SCATHA (satellite charging at high altitudes) satellite will be incorporated into the AFGL Geosynchronous Plasma Atlas to provide a final comprehensive specification of the geosynchronous and near-geosynchronous plasma environment. The specification will be the basis of a MIL standard.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, INSTRUMENTATION FOR SOLAR BURST DISK LOCATOR SOLAR-BURST-DISK LOCATION
D.N. Gaunt, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580850)

AF function - communications and surveillance. Deficiency - at present, burst disk location, an essential element of geophysical prediction, is obtained solely from optical observations, which are sometimes obscured by weather. Objective - to develop the techniques and instrumentation for determining burst disk position from interferometric observations. How research contributes - determination of burst disk position and motion will be helpful in understanding the phenomena and in predicting the travel path of solar energetic particles toward the earth.

Produce a data processing system which will generate a continuous, real-time (seconds) measurement of the position of a radioactive area from data presently available from an existing sweep frequency interferometer. The technique used will measure the displacement of the phase difference of signals (received from the two antennas of the interferometer) from that of a theoretical signal from the center of the sun and convert this to angular displacement which will determine position.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, LINE-OF-SIGHT CLIMATOLOGY
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Af function - operation of AF systems using visual or infrared wavelengths for detection or tracking and systems using millimeter-wavelength communications. Deficiency - AF systems designated above have operations which are often inhibited or terminated due to cloud, haze or precipitation interference. Cloud-free line-of-sight (CFLOS) probabilities are needed for AF operational areas. Objective - to determine probabilities of cloud-free and haze-free lines-of-sight from various aircraft altitudes to earth and to space. To develop precipitation-free clear line-of-sight (CLOS) and CFLOS atlases for various regions of the Northern Hemisphere based on radar observations, aircraft observations, and a statistical model using ground observations of cloud cover. How development contributes - CFLOS probabilities will aid designers and operators in determining the utility of AF systems. The atlases will depict regions where unacceptable risks of failure are expected. The microwave attenuation climatology will provide quantitative information on how often precipitation will affect transmission along millimeter wave ray paths at various elevation angles for differing climatic regions.

A LOS in-flight data collection program is being conducted to gather clear, cloud-free or hazy line-of-sight observations over Europe at altitudes of 10,000 feet and below. These in-flight observations are being made by U.S. Army helicopter squadrons in Europe. These observations, along with those previously collected, will be analyzed to determine clear, cloud-free and haze-free LOS probabilities to the ground, horizon, and sky from various altitudes along flight paths over Europe. A model has been developed which gives CFLOS probabilities through the atmosphere for 10, 20, . . . , 90 degrees elevation angles based on the climatic cloud cover statistics from a given location. The model will be applied to about 1200 stations to produce CFLOS atlases for regions of the Northern Hemisphere. Three-hourly radar-scope photographs were taken at 17 continuously-operating National Weather Service (NWS) storm radar sites in the U.S. National Climatic Center. Personnel at Asheville, NC have extracted data from these special photographic observations and will prepare them for computer analysis at AFGL. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, BEAM-PLASMA INTERACTION STUDIES
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AF function - satellite survivability, communications and surveillance. Deficiency - the characteristics of energetic charged-particle beams injected in the Earth's ionosphere and magnetosphere are not understood well enough to assess the space-environmental effects produced by such beams. Objective - to develop knowledge of the injection, propagation, reflection and deposition of energetic electron beams in the earth's ionosphere and magnetosphere. How research contributes - will provide an understanding of radio-wave emissions, secondary electron production and vehicle charging which result when an electron beam is ejected from a vehicle in space.

A study to determine the feasibility of performing scaled laboratory experiments will be conducted. Radio-wave emissions and secondary electron processes will be studied. Certain instabilities resulting from the beam-plasma interaction will also be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, STATISTICAL SPECIFICATION OF CLOUD COVER AND PRECIPITATION
T.J. Keegan, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581500)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information to meet military weather support requirements. Objective - to develop statistical relationships for the specification and prediction of total cloud amount and precipitation, based primarily on geosynchronous meteorological satellite data. How development contributes - successful development of these techniques will allow automated forecasts of cloud and weather conditions at many locations, satisfying AWS requirements specified in AWS TN 3-76.

A collection of GOES satellite video and IR data for Northeast U.S. will serve as a data base. Comparisons of satellite video and IR values around major aviation weather stations will be made with reported weather conditions and algorithms developed to specify and predict for up to six hours the probability of occurrence of cloud and weather conditions. Efforts will be made to ensure accurate navigation, and corrections will be made for varying sun angle. Emphasis will be on the warmer regions and month to avoid difficulties in discriminating between snow-cover and cloudiness, which is the subject of IHWU 76700903.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, 40 MHz DATA REPEATER DEVELOPMENT

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Function - advance balloon systems for surveillance, reconnaissance, communication telemetry and environmental research. Deficiency - the 40 MHz telemetry signals are limited to line-of-sight from Holloman AFB which is located in a valley between two mountain ranges. Objective - in order to increase the line-of-sight of a 40 MHz balloon telemetry system a repeater will be designed and tested. The repeater will be co-located with an existing 150 MHz communications repeater on top of a mountain peak near Holloman AFB. The repeater will be a dual redundant system which is remotely controlled by the ground control station located at Holloman AFB. How research contributes - with this repeater in operation, the line-of-sight distance can almost be doubled, saving money and manpower by not deploying telemetry vans for certain missions not requiring high data rate S-band telemetry.

Two 40 MHz FM receivers and two low power transmitters with appropriate antennas will be purchased. Two independent redundant repeaters will be designed with the receivers and transmitters. interface circuits such as narrow band audio filters, automatic modulation control, remote control and failsafe power control will be designed in-house. Integration of in-house designs with the receivers and transmitters will be accomplished with the aid of a contractor. An in-house maintenance instruction manual will be prepared after installation and test of the repeaters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, NAVPAC 1-2 AND 3 AND S77-2 SATELLITE DRAG MEASUREMENTS

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AF function - airborne surveillance, target acquisition. Deficiency or opportunity - atmospheric density variations with time and space cannot be adequately predicted. Objective - direct density measurements with new satellite-borne accelerometers. Results are analyzed to obtain improved density data as a function of geomagnetic activity and solar flux. How research contributes - in-flight accelerometer drag measurements permit accurate determination of Air Force system satellite ephemerides. Development of more accurate models permits improved satellite surveillance capability.

New SETA (satellite electrostatic triaxial accelerometer) instruments will be launched on AF satellites. The SETA instrument uses a single proof mass to measure accelerations in three orthogonal directions. This is a completely new development and supersedes the earlier technique of flying three orthogonal uniaxial MESA instruments. Density data will be obtained by determining the drag component along the velocity vector. Attitude will be determined from drag components measured by all three axes. The instrument will also be used to monitor spacecraft orbit-adjust thrusts. Data from the ROCA (rotatable calibration accelerometer) experiment on the S77-2 satellite will be reduced and analyzed to obtain aerodynamic drag measurements in near-circular orbits. The ROCA accelerometer is a single axis instrument with the capability to rotate the sensitive axis perpendicular to the velocity vector. This technique permits the determination and removal of inherent bias errors and leads to improved accuracy drag measurements. The accelerometer data will be analyzed to determine variability related to geomagnetic activity at a constant local time and the dependence of density on solar flux during a period of increasing solar activity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, INVESTIGATION OF 15 MICROMETER SATELLITE DISCREPANCY

R.A. McClatchey, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580300)

AF function - weather forecasting, weapons delivery, surveillance, deficiency - inability to adequately utilize satellite radiances in remote sounding of temperature and moisture. Objective - investigate sources of uncertainty in the calculation of radiances in the 15 micrometer carbon dioxide band. How research contributes - improves the ability to analyze and forecast atmospheric parameters of importance to military operations, particularly over data-sparse or data-denied areas.

Laboratory measurements of the 15 micrometer carbon dioxide transmittance will be analyzed with the object of establishing a more accurate transmittance calculation technique in this spectral region. Modified transmittances will be used to revise radiance calculations for comparison with satellite measurements. An experimental program will be carried out to study the relationship between radiometric temperature measurements and radiosonde data as a potential source of discrepancy between satellite measurements and ground truth calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, AURORAL AND AIRGLOW BACKGROUND STUDIES

R.M. Nadile, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580360)

AF function - atmospheric infrared backgrounds. Deficiency - lack of knowledge of infrared properties of the atmosphere. Objective -develop an auroral and airglow background emission model based on visible and infrared field measurements. How research contributes -accurate modeling of auroral and airglow emissions will provide a background predictive capability which can be used to evaluate future AF surveillance system designs.

An infrared auroral and airglow background predictive capability will be developed for selected spectral regions of interest to Air Force surveillance missions. This capability will be achieved through an analysis of an existing infrared data base, its comparison with simultaneous visible measurements, and their incorporation into a theoretical model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, COLLISIONAL DISSOCIATION AND EXCITED STATE REACTIONS OF ATMOSPHERIC SPECIES

J.F. Paulson, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582870)

AF function - weapons delivery, nuclear weapons effects. Deficiency - inadequate capability to predict ionospheric electron density profiles and TEC in naturally disturbed ionospheres or following nuclear detonations. Objective - to study and measure rates of reactions for collisional dissociation of negative cluster ions. How research contributes - provides information used in computer models to predict the effects of natural and nuclear atmospheric perturbations upon radio and radar communications, guidance, and surveillance systems.

The reactions of interest are studied in double mass spectrometer systems. Negative cluster ions are produced in a high pressure ion source. Time-of-flight techniques are used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, HIGH LATITUDE ATMOSPHERE RESPONSE TO GEOMAGNETIC HEATING

C.R. Philbrick, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584440)

AF function - ground, airborne and satellite radio communicators (VLF-VHF) and operation of satellite systems. Deficiency - d- and e-region ionization during stable auroral conditions and geomagnetic disturbance severely affects the operation of communications systems and is accompanied by heating that affects low altitude satellite ephemerides. Objective - to investigate the high latitude polar atmosphere response to the nighttime continuous aurora (Auroral-E), the daytime aurora, and to a major geomagnetic disturbance (energy budget campaign). How research contributes - the neutral atmospheric density and temperature measurements needed to study and understand the processes of the disturbed upper atmosphere will be made as a part of three cooperative rocket programs. The program for the continuous aurora will measure the energy input and atmospheric response under conditions where the relatively stable conditions should permit theoretical models and calculations to be checked. Another program will study the atmospheric conditions during a daytime aurora in conjunction with measurements of IR emissions. The energy budget campaign will investigate the poorly understood effects associated with a major geomagnetic storm. Our participation in the FRG sponsored energy budget campaign will make available, on a cooperative basis, the results of this major study of the upper atmosphere. The results from these three programs will form a basis for our understanding of heating sources and geomagnetic storm effects on ionospheric propagation and neutral atmospheric structure.

A 25cm diameter falling sphere instrumented with a three axis piezoelectric accelerometer will be launched together with other experiments on a rocket payload during the Auroral-E program from Poker Flat Research Range (PFRR). Two falling spheres will be launched together with chemical release payloads (provided by University College, London) from Kiruna, Sweden. The sphere measurements will provide mass density and temperature measurements between 40 and 160 km for both programs. Another 25cm diameter falling sphere will be launched at PFRR in conjunction with instruments for measuring IR emissions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, DETERMINATION OF STRATOSPHERIC WINDS AND TURBULENCE AS A FUNCT OF LATITUDE USING PHOTO OF SMOKE TRAILS

A.F. Quesada, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581160)

AF function - to gain quantitative understanding of stratospheric dynamics needed to predict environmental effects of AF aircraft and missile operations in and through the stratosphere. Deficiency -reliable prediction of emission effects from supersonic aircraft and missile operations is not available due to paucity of measurements of parameters that determine transport processes in the stratosphere. Objective - to measure parameters that characterize stratospheric dynamics in order to develop models that will accurately predict dispersal rates and residence times of materials injected into the stratosphere. How research contributes - will provide the data to define and model transport mechanisms.

Photographic observations of upper atmosphere or stratospheric smoke releases provide data relevant to the physical state and motion of the stratosphere or lower thermosphere. Of special interest are smoke trail positions, drifts, and growth, from which ambient winds, wind shears and divergences are determined by photographic triangulation. The results of these studies provide improved physical models of the atmosphere in the natural and disturbed state, as well as data on winds, wind shears and turbulence at supersonic aircraft operating altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0034, SPACECRAFT SHEATH MODEL 1

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Af function - AF satellite systems operate at synchronous altitudes where charging can occur due to natural causes and may give rise to effects deleterious to the systems. Deficiency - the plasma physics interactions responsible for spacecraft charging are not well understood at present and it is necessary to develop appropriate models in order to obtain this understanding. Objective - to develop descriptions of the plasma and energetic particle environment surrounding a spacecraft at high altitude and its spatial and temporal behavior. How research contributes - numerical simulation of plasmas techniques are employed to model the plasma physics interactions of the ambient environment with the spacecraft. Understanding of the interaction and the ability to model sheaths, beams, secondary effects and instabilities will contribute vitally to the solution of the spacecraft charging problem.

A spherically symmetric code has been developed employing a numerical simulation model. The motion of several thousand particles in the field of the spacecraft and their self-consistent field is followed. The code includes the quiet start technique, cloud in cell particle treatment, and distribution function smoothing. Photosheath effects are treated, as well as secondary electrons and electron and ion guns. Quantities calculated are the satellite potential, the sheath structure and the current to the satellite.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0035, MISSILE CEP IMPROVEMENT FROM IMPROVED GRAVITY MODELS

B. Szabo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582900)

AF function - strategic weapons delivery. Deficiency - current gravity models are inadequate to satisfy CEP goals of advanced ICBM's in the mid 1980's. Objective - determination of the impact errors of advanced long range ICBM's by utilizing improved regional and global gravity models. How research contributes - determines expected icbm impact errors due to various gravity models.

Gravity models (launch region and global) derived by new combination technique and from new gravity data (such as satellite alimetry) will be used for the determination of the omission and commission errors of the global model. This error will be combined with the launch region gravity model, GM, and launch site gravity errors for the total gravity dependent error of an advanced ICBM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0036, LOW ENERGY PLASMA MOTION

P.J. Wildman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF248940)

AF function - communication, surveillance and navigation. Deficiency - inadequate knowledge of bulk motion of ionospheric and magnetospheric plasma inhibits prediction of ionospheric irregularities and density gradients. Objective - use plasma bulk measurements to improve modeling of ionospheric dynamics at all latitudes. Develop improved instrumentation. How research contributes - permits prediction of mid-latitude trough and plasma morphology at high latitudes.

Data for PHR experiments on S3 series satellites will be analyzed to determine plasma bulk motions, and their variation with geophysical parameters. Criteria for improving instrumentation will be developed during the examination of the experiment data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0037, A STUDY OF THE GULF STREAM USING FREELY DRIFTING BUOYS

P.L. Richardson, Woods Hole Oceanographic Institution, Dept. of Physical Oceanography, *Main St., Woods Hole, Massachusetts* 02543 (OCE78 18017 A01)

During the last five years approximately 45 free drifted buoys have given surface velocities and trajectories in the Gulf Stream system. This project will analyze these data in conjunction with XBT temperature data, and satellite infrared data of the thermal structure and ship drift velocites. The objectives are to investigate: a) the deflection of the Gulf Stream as it passes over the New England Seamount chain, b) the formation of eddies over and in the lee of seamounts, and c) the properties (velocity, energy, shape, recirculation) of the Gulf Stream gyre. The data will be used to calculate statistics of the flow field in order to characterize the circulation properties of the different regions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0038, THE MORPHOLOGY OF STRATOSPHERIC PLANETARY WAVES

A.D. Belmont, Control Data Corp., *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DF056330; F49620-79-C-0160)

AF function-long range forecasting of meteorology and the state of the ionosphere are required to support flight and communications systems. Deficiency - little is understood of the dynamics of the upper stratosphere and mesosphere. Yet evidence is mounting that planetary wave patterns in that region are precursors of tropospheric changes. Ionospheric/tropospheric coupling, a popular topic, also suggests some interaction with that region of interest. Objective - to determine the planetary wave patterns in the stratosphere (16-55km) during the period 4/70 to 12/76 from satellite radiance data and to diagnose their spatial and temporal variations. Coupling with other layers is not within the scope. Contribution - improved understanding of the stratosphere, aid communications, possibly aid forecasting.

Satellite radiance data will be analyzed using regression techniques and available rocketsondes to determine average temperature in their stratospheric layers EQ (3-13km). These spatial and temporarily distributed data will be spectrally analyzed to determine the contributions of wave numbers 1-6.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0039, WMO COLLABORATING CENTER ON BACKGROUND AIR POLLUTION DATA

V. Cinquamani, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Data & Information Service, National Climatic Center, *Ashville, North Carolina* 28801 (D8-F0127; EC10 -17)

OBJECTIVE: Maintain a data base on precipitation chemistry results from a worldwide network of contributing stations.

FINAL OUTPUT: Annual reports published in conjunction with NOAA. Documents contain contributed turbidity data along with precipitation chemistry values for monthly samples.

PROGRESS: There are now 20 countries reporting on a total of 67 sites. The number of parameters being reported vary from 4 to 18 depending upon the sophistication of the reporting laboratory.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab.

5.0040, EXPERIMENTAL STUDY OF AEROSOL FORMATION MECHANISMS IN A CONTROLLED ATMOSPHERE

D.L. Fox, University of North Carolina, Chapel Hill Campus, School of Engineering, Dept. of Environmental Sciences & Engineering, *Chapel Hill, North Carolina* 27514 (R806070; GC2Q - 0639)

OBJECTIVE: Determine effects of volatile aerosol species on aerosol light extinction and visibility.

APPROACH: Generate test aerosols in large outdoor chamber and measure fine particulate mass concurrently with in situ measurements.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0041, NONLINEAR TRANSFER OF KINETIC ENERGY IN THE ATMOSPHERE USING ONE- AND TWO-DIMENSIONAL SPECTRAL REPRESENTATION

D. Djuric, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Meteorology, *College Station, Texas* 77843 (DF051280; AFOSR-78-3492)

AF function - the AF global weather center uses a numerical model to forecast global meteorological conditions in support of AF operations. Deficiency - the physics of the atmospheric energetics are obscured by numerical techniques and limitations. Objective - to investigate the nonlinear transfer of kinetic energy for the norther hemisphere by two methods and determine if the forecast models are correctly handling this important parameter and if the one and two dimensional spectral representations yield comparable results. Contribution - such spectral representations of dynamic models yield great insight into their representation of the physics and may be the future generation forecast model.

To use the spectral representation now available for the entire Northern Hemisphere and investigate the nonlinear transfer of kinetic energy. Both a one and two dimensional analyses will be used and a comparison of the two techniques made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0042, IMPROVED ANALYSIS METHODS FOR ATMOSPHERIC EXPERIMENTS

J. Simpson, University of Virginia, School of Arts & Sciences, Dept. of Environmental Science, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM78-10087)

This research develops statistical and physical tools to advance the ability to detect changes in one or more related variables in atmospheric experiments. The technique development is based primarily on the physical and statistical data from the Florida Area Cumulus Experiment (FACE) in which the investigators were participants.

One objective of the research is to examine the validity and physical reasons for a few cases providing most of the cloud seeding effect in FACE. Intensive meteorological case studies are being carried out which integrate data from digitized radar, aircraft, upper air and surface networks. A second objective is to develop new statistical tools to analyze relevant atmospheric processes. These tools will involve new multivariate formulations appropriate to skewed data, non-standard time series analyses, and a systematic study of the use of angular data in multivariate contexts.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0043, STUDIES ON FINITE AMPLITUDE, OCEAN WAVES

L.H. Larsen, University of Washington, School of Arts & Sciences, Dept. of Oceanography, *Seattle, Washington* 98105 (OCE78-11578 A01)

The focus of this project is on the identification and analysis of nonlinear surface wave behavior in the open ocean and over the continental shelves. The studies concern the modulation patterns and modulation scales of surface waves in the ocean. The effort concentrates on three main topics: numerical modeling of a wave system that self-modulates, sea-level variations associated with the passage of a wave packet, and the use of satellite imagery to examine spatial modulation patterns of ocean waves.

The major effort in this study is on the numerical work. Three problems stand out: (a) to investigate two-dimensional solutions with initial conditions containing two or more transverse wave numbers; (b) to model the Davey-Stewartson equations and study two-dimensional wave packets. This study ties in with the radiation stress study in which the non-planer wave contributions to the radiation stress will be evaluated; (c) to continue the plane, one dimensional studies on the statistics of interacting solitons, and interactions of solitons and topography. Existing data sets will be. analyzed for comparison with theoretical results.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0044, SYNOPTIC-DYNAMIC APPLICATIONS OF METEOROLOGICAL SATELLITE DATA

L.H. Horn, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (8-612; NA79AA-H-00011 MOD. #3)

TECHNICAL OBJECTIVES: a) Evaluation of satelllite data, especially temperature profiles, with emphasis on their application to weather prediction. b) Development of techniques to maximize usefulness of data in forecast related problems, especially in the short term for the field forecaster.

APPROACH: a) Evaluation of TIROS-N vertical temperature/moisture soundings over the U.S. by synoptic case study utilizing satellite and coincident rawinsonde data independently and in combination. b) Combination of satellite soundings and satellite wind vectors to the advantage of both using balance relationships to establish dynamic consistency. c) Monitor cyclogenesis with emphasis on determining early indications of the onset of major weather changes.

PROGRESS: a) A technique examining wind field perturbations from a running (time) mean to establish continuity of mesoscale features of the circulation has been verified with application to the Johnstown, Pennsylvania, flood situation. Plans are to apply the technique to satellite derived wind fields. b) A climatological study of Colorado cyclogenesis to establish a 'model' is currently underway. The purpose is to determine early indicators which can be determined by remote sounding. c) Man/computer interactive processing is being applied to the April 10, 1979 (Wichita Falls tornado) SESAME study to provide a data set for examining the dynamic consistency of satellite temperature soundings and satellite wind vectors.

SUPPORTED BY U.S. Dept. of Commerce, National Environmental Satellite Service, Meteorological Satellite Lab.

5.0045, TRANSFER OF INFRARED AND VISIBLE RADIATION THROUGH CLOUDS OF FINITE HORIZONTAL AND VERTICAL EXTENT 15227-GS

J.A. Weinman, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DA0F9223; DAAG29-78-G-0109)

To investigate the transfer of visible and infrared radiation through clouds of finite horizontal and vertical extent. Relevance. applicable to current research on obscuration by military smokes and natural clouds, and the interpretation of visible and infrared imagery from meteorological satellites. The research will provide a means to incorporate multiple scattering into the JTCG-MESSEP obscuration model, the lack of which is the most serious shortcoming of the model.

Extend both a Monte Carlo and a fast analytical model partly developed to provide radiances in the visible region from isolated clouds, into the infrared region. Consideration also will be given to the intrinsic cloud properties such as extinction coefficient, single scatter albedo, and scattering phase function; and the effects of the underlying surface and the atmosphere in which the cloud is imbedded.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, DIRECT FIELD SUPPORT TO IMMEDIATE ARMY AEROMEDICAL AND GROUND VEHICLE PROBLEMS (DA 0C6895)

R.N. Armstrong, U.S. Dept. of Defense, Army, Medical Research & Development Command, Field Research & Biomedical Applications Div., *Fort Rucker, Alabama* 36362 (DA0G0162)

To provide biomedically pertinent information and solutions to resolve immediate operational field problems in areas related to the interface of the physical and life science aspects of aviation and ground vehicles including evaluations of conceptual proposed and first article equipment and systems.

The application of physiological and medical evaluative testing techniques, prior research data, and user questionnaires to assess, enhance, and validate equipment and systems proposed to resolve immediate medically related field problems. It will involve laboratory dynamic impact and acoustic noise attenuation test of helmets, field assessments of protective clothing, simulated and field investigations of vehicle seat configurations, flight testing of the medical aspects of rescue equipment and the evaluations of advance aircraft and ground vehicle designs with respect to toxicology, heating, ventilation, downwash and crashworthiness.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, AIR FORCE SKILLS MAINTENANCE AND REACQUISITION TRAINING RESEARCH PROGRAM PHASE I-PRELIMINARY EVALUATION

E.E. Eddowes, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223960)

Develop and validate comprehensive, quantitative, objective procedures which will permit the Air Force to manage an individualized flying training program which will provide acceptable mission readiness at minimum cost. This work unit will document the planning and management of the air force skills maintenance and reacquisition training research program (Project SMART).

The objective of this research will be achieved through the sequential accomplishment of the following four phases- 1. Preliminary evaluation of project smart methodology. 2. Identify and define critical flying skills and develop and validate objective procedures for measuring them. 3. Measure the retention of mission readiness skills as a function of the duration of nonflying period. 4. Evaluate the effectiveness of alternative flying training programs designed to maintain or foster rapid reacquisition of mission readiness skills.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, THE DEVELOPMENT OF AN AUTOMATED OBJECTIVE PERFORMANCE MEASUREMENT SYSTEM FOR ASUPT

W.L. Waag, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF221220)

The principal objective is the development of an automated objective performance measurement system to be used in training research employing ASUPT. Since positive transfer effects are assumed, it is possible to use measures of pilot performance in ASUPT as the criterion against which to evaluate alternative simulator hardware configurations and training strategies. A further objective is the development of an empirical data base reflecting performance standards of both experienced instructor pilots and students as they progress through the simulation training program. The scope of the effort is the development of measures for all flying phases of UPT which will be taught in ASUPT. The output will be a series of 'flying tests' directed toward the assessment of proficiency at various levels of training.

A criterion-referenced approach to pilot performance measurement has been adopted. It is assumed that superior maneuver performance manifests three characteristics: (1) accomplishing the criterion objectives as defined by the aircraft state parameters, (2) avoiding excessive rates and accelerations so that the maneuver is executed smoothly, and (3) accomplishing these objectives with the least amount of effort by minimizing control inputs. The development of the measurement system will require four phases: (1) definition of the criterion objectives for each maneuver in terms of a potential set of simulator parameters, (2) evaluation of the proposed set of measures for the purpose of validation and simplification, (3) specification of criterion performance by requiring experienced IPS to fly the maneuvers in question, and (4) the collection of normative data using students as they progress through the training program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, ADVANCED CONCEPTS IN AIRCREW PERFORMANCE MEASUREMENT

D. Vruels, Canyon Research Group Inc., *32107 Lindero Canyon Rd., Suite 123, Westlake Village, California* 91361 (DF055170; F49620-79-C-0072)

AF function - this research supports Air Force flying training R&D programs. Deficiency - the science of objective aircrew performance measurement is rapidly developing in the Air Force, Army and Navy R&D communities in conjunction with new training devices, especially operational flight trainers and full mission simulators. At this time this development is roughly in three parallel and separate tracks, one for each service, which does not take advantage of advances made within the community. While some measures will be unique to a specific service's aircraft and mission, other measures will share a commonality between services. At this time, our limited knowledge of performance measurement techniques does not allow rigorous standardization across efforts. Objective - the objective of this research will be to study aircrew performance measurement efforts within the Air Force, Army and Navy R&D communities and develop a framework for establishing standards of how performance measurements should be made and reported. How research contributes - this research will determine if the three services can have complementary programs in aircrew performance measurement and specify in which areas commonalities can be maximized by establishing standards for measuring and reporting dependent measures in empirical research.

The principal investigator will examine ongoing programs in performance measures development among the three services as well as the current technologies which other R&D communities use to standardize or calibrate their measurements. Several candidate measures will be selected along a range of complexity and procedures for isolating the common elements will be developed. Standards will be attempted for these measures and, if successful, procedures which will permit the work to be expanded to other measures will be developed. This effort will be conducted under the supervision of a tri-service working group of scientists from the training R&D community which will guide the principal investigator in his selection of measures and evaluate the resulting standardization efforts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, APPLICATIONS OF EVENT-RELATED POTENTIALS IN HUMAN ENGINEERING

E. Donchin, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Psychology, *Urbana, Illinois* 61801 (DF056940; F49620-79-C-0233)

AF function - Air Force systems have become increasingly complex and sophisticated. The effective operation of these complex systems depends on the ability of the human operator to process and integrate the wide variety of information presented to him from an enormous array of displays. Deficiency - the human operator of complex systems must make decisions rapidly based on sometimes insufficient data. New approaches must be developed which will increase the capability of the operator to communicate with his weapons system. Objective - the research will develop a cognitive psychophysiology relying on computer-aided analysis of the eletroencephalogram (EEG) and specifically the extraction of components of the human event-related brain potential (ERP) in terms of their amplitudes. How research contributes - the development of new psychophysiological techniques will provide a battery of tools which have serious prospects as valuable aids in human engineering. The research would permit the measurement of relevant ERP parameters on line, in real time, and following single presentations of evaluated events. A method would be provided for the assessment of workload, the evaluation of display designs, the anticipation of stress and fatigue, and the assurance that important data are not missed to help meet new challenges with which engineers and human operators must cope.

During the first year of a proposed five year plan of research, six experiments will be conducted - 1) investigation of the effects of manual tracking display and ERP program modality (auditory vs. visual) on the amplitude of the P-300 component, 2) examination of the readiness potential preceding a target 'capture' response during continuous monitoring of task workloads, 3) exploration of the nature of events within a simulated air traffic control display that can index resource allocation through P-300 amplitude, 4) systematic experimentation of a number of stimulus parameters that influence the 'expectancy' component underlying variance in P-300 amplitude, 5) examination of the degree of cerebral localization of spatial wholistic vs. analytic information processing by assessing the lateral symmetries in ERP's association with processing each of the two categories of stimuli, and 6) employment of P-300 in a reaction time paradigm as an index to reflect the latency of internal mental events. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0006, THE EFFECTS OF ENHANCED DISPARITY ON MANUAL CONTROL

R.V. Kenyon, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF057960; AFOSR-80-0129)

AF function - Air Force pilots, particularly fighter pilots involved in combat maneuvers, must make very fast, very accurate decisions about the position and orientation of objects in space. This research investigates the possibility of increasing the pilot's proficiency and speed in making these decisions by artificial augmentation of his binocular depth cues. Deficiency - at distances beyond 100 meters, the human's ability to utilize binocular information from the position or orientation of an object in space is drastically reduced. Resulting ambiguities can have deleterious effects on the reaction times and decisions needed for optimal flying. However, artificial augmentation of binocular depth cues could result in space distortions and double images. This research systematically studies the trade-offs involved by studying performance as a function of amount of binocular disparity. Objective - to assess the utility of controlled amounts of artificially enhanced binocular disparity on subject's visual-motor performance in situations where only monocular cues would normally be available. How research contributes - knowledge of whether or not artificially induced binocular disparity contributes to performance of visual-motor tasks will be interesting to people in the general scientific community who are studying vision, psychomotor behavior and information processing. It will also stimulate and support Air Force research efforts covered under RO's 1.2 and 1.4.

The investigator will examine performance on memory tests and performance on a range of imagery tasks in a group of 100 college students. He will do a task analyses to generate and test specific hypotheses regarding the basis processes (component functions) required in each complex task. He will then attempt to correlate efficiency of the predicted component functions with performance on the various complex tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, ASSESSMENT OF SCENE COMPLEXITY AND CUE VALIDITY IN VISUAL FLIGHT SIMULATION

H.G. Shulman, Ohio State University, Columbus Campus, School of Arts & Sciences, Dept. of Psychology, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF055140; F49620-79-C-0070)

AF function - this research supports air force programs in aircrew training, especially flight simulator technology. Deficiency - computer generated image systems allow many different visual scenes to be presented to pilots flying in sophisticated simulators. Little is known about which scene features are most important to achieve high levels of training transfer. Further there is no adequate measure of scene complexity to use to describe different scenes. Objective - this research has two objectives. It will study earlier attempts to measure scene complexity and develop a valid metric for use by training researchers and it will develop the methodology for assessing the importance of different scene features for training various flying tasks. How research contributes - this research will provide useful methodological tools which researchers in training simulation can use to develop optimum visual simulations for aircrews.

Two research tasks will be pursued. 1. The human visual system will be assumed to analyze information about the distribution of spatial frequencies in a scene by using autocorrelations. A method will be developed for calculating autocorrelations for a given scene and relating them to human performance on tasks which are relevant to simulated and acutal flight. If a strong relationship is established between this metric and performance, then it can be used to establish training efficiency, along a continuum anchored by simplified schematic images on one end and high detail, realistic images on the other. 2. The principal task of a pilot using terrain features in controlling his vehicle is assumed to be the use of key transformations in the visual scene for determining depth, altitude, speed, vertical velocity, etc. Using a interactive visual flight simulator, the research team will try to isolate these transformations and develop custom tailored visual scenes which speed the learning of transformations for students learning specific tasks.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0008, NO PATHOLOGY THRESHOLD

A. Hall, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320470)

To develop nationally recognized data on chronic inhalation exposure effects of volatile Air Force chemicals and to provide safe occupational exposure limits (threshold limit values) which constitute concurrence with the occupational safety and health act as directed by executive order. The no pathology threshold portion of job order number 63020620 has been transferred to this new workunit.

To establish an acceptable, non-injury concentration of Air Force chemicals under subacute and chronic exposures for the primary target organs. The methods used will be gross, light microscopy, and electron microscopy of animal tissues exposed to the test chemicals. Hematological, clinical chemistry, microbiological, and immunological findings will be evaluated. Stringent quality control on animals used in subacute and chronic toxicology studies will be maintained. The data and recommendations for safe exposure level are provided the Air Force Surgeon General and the National Academy of Sciences committee on toxicology to obtain approved exposure criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0009, OPERATOR HEAD/EYE CONTROL CHARACTERISTICS

J.P. Hornseth, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321040)

The main thrust of this workunit will be to determine the conditions under which it is desirable to use the head or eye for manned and unmanned aircraft piloting, weapon delivery, and sensor control. The research effort will concentrate on determining the natural characteristics of hand, head, and eye tracking, including the effects of environmental stressors on these characteristics. An integral component of the research will be the effects on control performance of image format and location in the visual field of displayed feedback and secondary task information. The results will provide data required for the selection and specification of control-display systems proposed for operational applications. The research will also identify promising new techniques of harnessing the operator in control task situations and suggest further development or prototype application and evaluation.

Experimentation will be conducted in a fixed-base laboratory and in simulated flight environments incorporating vibration and Gz stressors. When practical, data from complementary in-flight tests will be used to validate the ground-based results. Operator control performance with a hand controller, the helmet-mounted sight, and the oculometer will be investigated to establish a data base of operator pointing accuracies and frequency response which will document the performance tradeoffs for hand, head, and eye controllers. Concurrent experimentation on a vibration simulator will begin to quantify the effects of a buffetting environment on head control and seek to develop software techniques to compensate for errors induced by the head rotational system's vibration transmissivity. Experimentation to be conducted on the AMRL centrifuge will compare hand, head, and eye control performance under Gz acceleration to determine the mode of response that is best for an operator to use in aiming the fire control system in a high performance aircraft. Additional laboratory experimentation will explore natural head-eye coordination. The results will influence the design of the helmet-mounted sight reticle and the development of a helmet-mounted oculometer. This effort was previously reported under workunit 7184-04-43, control concept development.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, DATA REDUCTION AND BIODYNAMIC MODELING

D.G. Leet, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF323720; F33615-78-C-0504)

The constant trend toward the design and development of faster and more mobile aerospace systems requires an increasingly greater understanding of man's interaction with and tolerance to the physical environmental demands of such systems. The present program is for the purpose of quantitatively defining given biodynamic environments, determining the physical and physiological properties and responses of the human body with respect to vibration, blast and impact force environments encountered in high-performance aerodynamic operation and during emergency procedures, providing necessary data in proper format for formulating injury criteria and tolerance limits and developing mathematical and computer models to describe complex biological functions.

This program will include the development of experimental biodynamic data reduction techniques, formulation of new and modification of existing computer programs for the simulation of human body dynamics, the generation of quantitative definitions for injury criteria based on such body models, analytic investigations of body tissue properties and development of mathematical methods applicable to the study of biological systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0011, METABOLISM OF HYDRAZINE

F.N. Dost, Oregon State Higher Education System, Oregon State University, School of Agriculture, Dept. of Agricultural Chemistry, *35th & Jefferson Sts., Corvallis, Oregon* 97331 (DF320680; F33615-79-C-0517)

Research is needed to characterize metabolic pathways of potential Air Force pollutants in selected animal species to provide data for estimating if man metabolizes compounds similar to specific animals. Metabolic pathways must be identified for risk prediction on potential chemical oncogenic compounds. In particular, the biological effects of hydrazine exposure have been and are being extensively investigated, but the metabolic disposition of at least 50 percent of administered hydrazine is still unknown. The specific objective is to study the metabolic fate of the missile propellant hydrazine to aid in a better understanding of the oncogenic potential of the compound. The data will also help to develop toxicity criteria for the USAF as required by AFR 19-1.

The research proposed here is first intended to account for all hydrazine nitrogen administered, by determining the amount

of hydrazine nitrogen that appears in respiration, urine and tissues as hydrazine, N2 and ammonia, and other metabolites. The potential for formation of certain probable intermediates, particularly diimide, will also be studied. The investigation will utilize the rat as the primary research animal while various chemical analyses and mass spectroscopic measurements of 15 N from 15 N-hydrazine will be employed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0012, PERSONNEL TECHNOLOGY: COGNITIVE-FACTORS ANALYSIS OF SKILLED HUMAN PERFORMANCE

S.W. Keele, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Psychology, *1472 Kincaid St., Eugene, Oregon* 97401 (DN775694; N00014-77-C-0643)

This work will explore a cognitive-factors approach to analysis and prediction of skilled performance under high information loads characteristic of those found in piloting, fire control, and other military jobs. The work seeks to establish the construct validityof a number of cognitive abilities, including attentional flexibility, time-sharig, concentration, spatial orientation, and executive functions. Measures of these factors will be derived and empirically evaluated in terms of both concurrent and predictive validity.

Further validation studies will be carried out for previously refined measures of attentional flexibility. The construct validity of the concentration factor will be studies using tasks measuring the ability to disregard target information presented on to-be-ignored channels. Previously discovered factors of time-sharing ability will be construct-validated, and measures calibrated on experienced pilots. At least one new task will be formulated to assess executive function. A four-task assessment battery for spatial abilities will be tried on flight-training students.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0013, WIDE ANGLE MULTI-VIEWER INFINITY IMAGE DISPLAY

A.L. Zepf, American Airlines Inc., *Fort Worth, Texas* (DF228790; F33615-79-C-0002)

The purpose of this effort is to determine the feasibility of fabrication and to evaluate the potential optical performance of an optical display to provide the out-the-window scene for a multi-crewmember cockpit. Parallel design studies sponsored by AFHRL have recently recommended a large spherical mirror viewed off-axis as the imaging system most likely to meet the design goals stated. Because the technology to produce these large mirrors is untried and considered to be high risk, this effort will reduce the risk prior to fabrication of a full scale demonstration system by developing basic fabrication techniques on a smaller scale.

Based on the results of the previous parallel design studies, a final design will be developed to resolve the differences between the study results. Various fabrication techniques for the large mirror and for the rear projection screen will be investigated and one will be selected for further development. Assembly and alignment procedures will be developed and a small test section will be fabricated to permit evaluation of the fabrication and assembly methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0014, MAINTENANCE OF AIR FORCE HUMAN RESOURCES DATA BASE

C.C. Fresne, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF232750)

Continuation of 63230101 - to collect, document, maintain, and update automated personnel data for Air Force officers, enlisted personnel, and the civilian work force. To organize these data in readily accessible data bases for support of research studies of the personnel system.

Automated standard and command-unique personnel data files will be acquired, edited, and reformatted. Data for all military accessions, flying and technical training, reenlistment and separations, and strength files will be included. Nonautomated documents containing performance and evaluation data will be acquired and converted to machine-compatible form. Milestones - Apr 78 & annually, CY 77 update of Basic Military Training File. Apr 78 & annually, processing of Dec 77 UAR/UOR active. May 78 & annually, processing of FY 77 Navigator Detailed History File. Jun 78 & annually, CY 77 preparation of AFOQT data. Aug 78 & annually, requirements for continuing receipt of approximately 30 source files including UAR/UOR active (tri-annually), UAR/UOR Reserve/ANG (annually), Technical Training (quarterly), Basic Military Training and OTS (monthly), Flying/Navigator Training (annually), etc. Oct 78 & annually, processing of Jun 78 UAR/UOR Active Files. Dec 78 & annually, processing of Sep 78 UAR/UOR ANG/Reserve files. Jan 79 & annually, processing of Sep 78 UAR/UOR Active Files. Feb 79, processing of Sep 78 AFROTC Applicants/Advanced/Commissioned Losses files. Mar 79, processing of CY 78 Technical Training File.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0015, TASK LOAD AND OPERATOR ATTENTION CAPACITY IN TIME SHARING PERFORMANCE

D. Gopher, Technion, *Haifa, Israel* (DF046760; AFOSR-77-3131)

AF function - this research supports aircrew training, aircrew performance in high task load environments (e.g., combat), and overall force readiness. Deficiency - as the role of the pilot is shifting from a direct controller of aircraft functions to a monitor and decision maker in a complex, dynamic, and intelligent man-machine systems, we need to measure those abilities which support this new role. The increasing complexity of flight missions combined with the growing sophistication of airborne systems and the concurrent increase in production and training costs emphasize the need for improved assessment techniques for pilot attention capacity and task loads. Objective - the research activity will follow three major lines - (1) development of a quantitative assessment of time sharing efficiency, (2) training for time sharing, and (3) development of software packages, including feedback devices and adaptive techniques. How research contributes -improved techniques and prediction equations for the evaluation of task load and operator efficiency in time sharing situations will be utilized in system design and development, the structuring of aircrew training programs, and the assessment of the workload quotient of various tactical maneuvers.

The research will be devoted to achieving the following goals - (1) crossvalidation and improvement of procedures developed during the first year, (2) expansion and diversification of the investigation of performance limitations by adding new tasks to the existing battery. Visual monitoring, memory, reaction time and dichotic listening tasks have been constructed and incorporated in experimental designs, (3) experimentally investigate both dual-task and triple-task conditions, (4) increase emphasis on developing theoretical concepts that can tie applied human factors research with the general theory of attention.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, SIGNAL AND NOISE GENERATION IN CURVED AND FLAT SPACE-TIMES

U.H. Gerlach, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Mathematics, *164 W. 17th Ave., Columbus, Ohio* 43210 (PHY79-21358)

Research in theoretical gravitational physics initited under NSF grant PHY77-04983 will be continued.

Within the framework of Shannon's mathematical theory of communication (1) a black hole as well as (2) flat space-time viewed by an accelerated observer are described as noisy communications channels. Questions about noise generation as well as about the quantum (level) structure of these channels are examined. The limitations imposed by quantum physics on Shannon's theory are examined.

A highly efficient theory together with applications are developed to examine the generation of coupled gravitational, electromagnetic and acoustical perturbations of arbitrary spherically symmetric bodies in curved space-times.

Quasi-normal modes of spherically symmetric as well as of rotating black holes are examined from the point of view of Regge pole theory in complex total as well as polar angular momentum plane.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

7.0002, MULTIVARIATE DATA ANALYSIS - SIMULTANEOUS COMPARISON TEST

P.R. Krishnaiah, University of Pittsburgh, School of Arts & Sciences, Dept. of Mathematics & Statistics, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DF140650; AFOSR-77-3239)

Part of AFFDL's responsibility is the development of advanced flight control systems and crew stations. The use of electro-optical, multi-function controls and displays in advanced crewstations places many new demands upon the pilot's visual and information processing channels. In addition, in order to compare candidate flight control systems and crew station components, simulations and flight tests are conducted in which pilot performance is measured. However, there is no single measure of pilot performance, thus requiring the collection of many kinds of performance data and their analysis by means of multivariate statistical techniques. The objective of this work effort is twofold- (1) to examine visual information processing techniques employing fast Fourier transforms, and (2) to evaluate available multivariate statistical techniques for simultaneous comparison of mean vectors and the development of computer programs to implement these techniques. Objective 1 will result in optimized symbol formats for electro-optical displays in advanced crew stations. Objective 2 will provide a means of determining which of the candidate crew stations/flight control systems is best for the pilot.

Objective 1 - automatic pattern recognition techniques will be employed to evaluate symbol confusability both within and between symbol sets. Objective 2 - seven currently available multivariate statistical techniques will be evaluated by the contractor as to their robustness to violations of the assumptions of homogenity of the population covariance matrix and the normality of the multivariate distribution. The most robust technique will be implemented by means of computer programs which will be available for use by AFFDL personnel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

7.0003, NUMERICAL SIMULATION OF SPACECRAFT CHARGING PHENOMENA

J.G. Laframboise, York University, *Toronto, Ontario, Canada* (DF043460; AFOSR-76-2962)

AF function - electrical and surveillance systems on Air Force satellites have been disrupted by transient signals associated with differential charging of the spacecraft. Deficiency - theoretical studies of spacecraft charging are needed to aid in the design of experiments and the interpretation of the data. Objective - a numerical model is to be developed to simulate the plasma sheath surrounding a spacecraft. Contribution - this study will provide a theoretical model to understand the data obtained from the SCATHA (spacecraft changing at high altitude) satellite and other spacecraft charging phenomena.

The computer program describing the spacecraft and plasma sheath interaction will be tested and validated by making theoretical predictions of the charging behavior of sample spacecraft configurations. The validated program will be used to investigate -effects of surface materials and surface conductivity and their variation with position, spacecraft-rotation relative to sunward direction, time-dependent ambient plasma distribution, spacecraft geometry and sheath potential, different floating potentials on isolated surfaces. The program will be modified to permit calculations involving non-circular two-dimensional geometries which could be used to model antenna shading of a spacecraft body or shaded cavities where unusually severe arcing has occurred.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, A STUDY OF LOW-TEMPERATURE PROCESSES IN NON-EQUILIBRIUM ELECTRONIC STATES

J.C. Solinsky, Advanced Research & Applications Corp., *1223 E. Arques Ave., Sunnyvale, California* 94086 (DF051030; F49620-78-C-0010)

AF function - the proposed research primarily falls in the 2.3 research objectives which deal with developing superconducting materials with higher transition temperatures, higher critical magnetic fields, lower AC losses and higher current carrying capabilities. This is also a model system to study non-equilibrium effects in general. Deficiency -new approaches to Air Force power generation and distribution and remote sensing and detection of electromagnetic radiation depend upon new and improved superconducting materials. Josephson junction devices are needed for ultrasensitive detectors of electromagnetic radiation especially in the ranges of 1.100 micrometers and 10 to the 6th and 10 to the 5th gauss. Objective - this proposed program continuation focuses on non-equilibrium processes in their Sn-SnO-Sn superconducting Josephson junctions near 4K. Non-equilibrium processes in superconductors have renewed theoretical attention because of problems in high-frequency weak links. Definitive experimental evidence is necessary to further the understanding of these phenomena. One possible result of an improved understanding is the eventual development of superconducting material with increased transition temperatures.

The approach is to study the superconducting non-equilibrium states by investigating perturbations in one superconducting material using another superconducting material as the paired field probe. The two superconducting materials are fabricated as a Josephson junction and the Josephson tunneling current provides the measurement of the non-equilibrium. Electrons are excited to momentum states that are above the normal average phonon-affected electron states, by a photon or phonon perturbation. These are the non-equilibrium states and are above and below the Fermi energy level in momentum. They form a set of paired electrons that have a lifetime. During this time of pairing, the number of paired electrons is increased which, in turn, increase the superconductor order parameter. This appears as an enhanced energy gap. In a tunneling experiment, an increase in the gap appears as an increase in critical current.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, COMMUNICATIONS: ATOM-MOLECULE SCATTERING

B. Liu, International Business Machines Corp., Research Laboratory, *Monterey & Cottle Rd., San Jose, California* 95114 (DN975428; N00014-79-C-0230)

Atom-molecule reactive and nonreactive inelastic collisions are two processes which determine the equilibrium concentrations of atomic and molecular species and internal energy distribution of these species in the atmosphere and gaseous lasers. They are also important processes determining the return to equilibrium of a disturbed atmosphere. Understanding energy deposition in these processes is thus important to naval communications and surveillance and the Navy laser program.

Classical trajectory calculations of reaction rates for excited oxygen atom and hydrogen molecules are being computed. Potential surfaces for ground and excited oxygen atoms with Hx molecules where x is F, Cl, Br are being computed. Finally,

techniques for computing coupling matrix elements are being investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0003, INFRARED HETERODYNE SPECTROSCOPY
C.H. Townes, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (AST79-20845)

The Berkeley group, C.H. Townes, principal investigator, is one of two with a working infrared heterodyne spectrometer. Basically the infrared radiation from the object of interest and the output of a CO2 laser (local oscillator) are mixed on a photodiode, down-converting the signal to radio frequencies. This technique has already been used to detect ammonia in the carbon star IRC plus 10216, the first detection of this molecule in a stellar source. Townes and his co-workers want to apply the technique to other stellar objects to study the dynamics and chemistry of mass loss in stars. The IR heterodyne approach allows higher spatial resolution than radio telescopes and better velocity resolution than other infrared techniques. It will also provide data complementary to that from radio astronomy for molecules in interstellar clouds.

Under this grant, the bandwidth of the filter bank will be doubled, allowing a much wider range of velocity components in molecular lines to be studied. A small control computer will also be added to allow transportation of the system to telescopes of larger aperture, opening a wider range of objects to study with this promising new technique.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0004, PLASMA COLLECTIVE ION ACCELERATION
A. Fisher, University of California, Irvine Campus, School of Physical Sciences, Dept. of Physics, *Irvine, California* 92664 (DN975487; N00014-79-C-0560)

The Navy needs quantitative information on methods to generate intense ion beams with energies up to 1 GeV for directed energy applications, sources of intense radiation through impact with targets, new sources of energy via interaction with pellets, etc. The electron beam front collective acceleration of ions to be carried out in this contract has the scaling characteristics which are necessary to fulfill the requirement stated above.

The beam front of a high current relativistic electron beam creates a very strong electric field capable of accelerating ions to GeV energies over short distances. Controlling the motion of the electron beam front over distances of 10's of meters has been a major problem in the area of collective acceleration. In this contract, two novel concepts are utilized to accomplish this: (a) the use of a strong longitudinal magnetic field to maximize the length of propagation and (b) the use of a programmed, externally generated plasma to provide the charge neutralization needed to propagate the space charge limited intense beam current front.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0005, A STUDY OF MAGNETOSPHERIC HYDROMAGNETICS
M.G. Kivelson, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM79-23586)

This grant will support a multifaceted study under the umbrella title of magnetospheric hydromagnetics. The aim is to study varied aspects of hydromagnetic flow and waves in the coupled system formed by the magnetosphere and ionosphere. The approach will mix theory and data analysis. Many of the results should be of general significance to understanding collisionless plasmas.

The specific investigations to be undertaken include: further development of empirical time dependent modeling of plasma evolution under convection; modeling of instability development in plasma distributions through convection; establishment of the relative importance of acceleration and plasma redistribution in injection events; examination of the spatial structure and extent of low frequency resonant hydromagnetic waves in the magnetosphere and their temporal duration; analysis of energy transfer and particle transport in the magnetosphere-ionosphere system by hydromagnetic waves.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0006, EXCITED STATE CROSS-SECTIONS IN CARBON MONOXIDE
R. Poe, University of California, Riverside Campus, School of Physical Sciences, Dept. of Physics, *Riverside, California* 92502 (DF461220; F33615-77-C-2011)

Obtain theoretical values for electron impact cross sections in carbon monoxide. Cross sections will include momentum transfer, rotational, and vibrational excitation for ground and excited vibrational-rotational states.

Semi-classical and quantum methods will be employed in numerical solutions of inelastic scattering of electrons from molecules with permanent dipole moments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

8.0007, NUCLEAR MAGNETIC RESONANCE IN SOLIDS
C.P. Slichter, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics/Materials Research Laboratory, *106 Engineering Hall, Urbana, Illinois* 61801 (EY-76-C-02-1198)

The interests of this group are in fundamentals of solid state physics including many-body problems, phase transitions, magnetism, and solids which possess exotic properties. Most of the present work involves use of nuclear magnetic resonance to probe magnetic and electric fields in solids. As an example, we recently studied what happens to the magnetism of an atom which is normally magnetic (e.g., chromium, manganese, iron) when imbedded in a nonmagnetic metal (copper). By observing the nuclear resonance of copper atoms which are near neighbors to the 'magnetic' atom, we have been able to test theories about the electronic structure of the magnetic atom, providing information not previously available. We have begun studies of catalysis, working on Pt-alumina catalysts in conjunction with Dr. John Sinfelt of the Exxon Research Laboratories. We see dramatic differences in the 195 Pt NMR as we vary the Pt particle size for 10 Angstrom units to 40 Angstrom units which reveal the effects of phenomena on the surface on the electronic structure of the Pt particles. We are also currently studying charge density waves in transition metal layer compounds. We make extensive use of special methods such as observing the resonance of one species of nucleus while exciting a second resonance, to enable us to see resonance other wise too weak to observe.

SUPPORTED BY U.S. Dept. of Energy

8.0008, SOLITONS AND IONOSPHERIC MODIFICATION
D.R. Nicholson, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (ATM79-18778)

The large amount of theoretical effort that has gone into the explanation of plasma phenomena involved in ionospheric modification by intense radio waves, has thus far omitted the formation of intense packets of high frequency waves known as solitons. This grant will support extention of present theory to incorporate the possibly very important effects of soliton formation. The effort will be directed towards comparison with observations, particularly future high power observations of high frequency wave spectra (plasma line scatter) and accelerated electrons (airglow). This study will first treat the case where the modifier electric field is parallel to the background magnetic field near its reflection point, permitting a theory with variations

only in one dimension, as an important preliminary step to the more realistic two- and three-dimensional calculations which will follow.

In two or three dimensions soliton collapse is not stopped by dispersion but proceeds catastrophically until very intense localized electric fields are obtained. This multidimensional calculation is more likely to yield predictions in accord with observation, but is complicated by the presence of the background magnetic field. Careful study of the degree to which the background magnetic field effects are small will determine the degree to which one can use existing powerful numerical tools which have been developed for the unmagnetized situation. Finally, analytic and numerical techniques will be employed to build a model which predicts three-dimensional wave levels, wave spectra, and the resulting accelerated electrons.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0009, THEORY OF ATOMIC STRUCTURE

B.R. Judd, Johns Hopkins University, School of Arts & Sciences, Dept. of Physics, *34th & Charles Sts., Baltimore, Maryland* 21218 (PHY79-21257)

Research in theoretical atomic physics initiated under NSF grant PHY77-22488A01 will be continued. The atoms investigated are either free or embedded at isolated sites in crystals; they are subjected to a variety of external fields. The principal topics to be investigated include: a. pseudo-quadrupole transitions of rare-earth ions; b. the Jahn-Teller Effect; c. correlation crystal fields; d. quasi-particle methods in shell theory; e. structure of angular-momentum theory; f. laser-atom interactions; g. weak neutral currents in atomic physics; h. photoionization of atoms.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0010, DYNAMICAL THEORY OF CHARGED PARTICLE SYSTEMS

H.A. Gould, Clark University, School of Arts & Sciences, Dept. of Physics, *Worcester, Massachusetts* 01610 (DMR78-10306)

Theoretical research in condensed matter physics will be carried out. Past work on self-diffusion in a dense one-component classical plasma (electron gas) has shown that it is possible to perform realistic microscopic dynamical calculations of charged particle systems in the absence of a small perturbation parameter. The theory will be extended to treat the dynamical properties of superionic conductors and molten salts. The techniques and insights to be developed will also be applicable to a highly compressed plasma, quantum liquids, and classical dense gases. The theoretical calculations will be compared to results obtained from experiment and molecular dynamics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0011, HIGH RESOLUTION VACUUM ULTRAVIOLET SPECTROSCOPY OF SMALL MOLECULES

W.H. Parkinson, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DF045930; F49620-77-C-0010)

AF function - surveillance, detection and communications, laser development in the near UV region of the spectrum. Deficiency - there is a lack of sufficient data to characterize the degree of photopredissociation of N2 in the upper atmosphere. Adequate understanding is lacking of the detailed spectroscopy and dynamics of rare gas excimers which can act as VUV lasers or energy storage states for transfer to the upper laser level of other species. Objective-determine photopredissociation processes in N2 at 800-1000 Angstroms and determine high resolution vacuum ultraviolet spectroscopy of van der Waals molecules. How work contributes - a high resolution spectroscopic investigation of the photopredissociation of N2 as a source of excited N(2D) atoms is important in determing the amount of vibrationally excited no molecules in the upper atmosphere which are produced by reaction of N(2D) with 02. The lowest excited electronic states of the van der Waals molecules such as the diatomic rare gas molecules are important to the development of intense VUV sources and lasers. Spectroscopic investigation of these molecules will establish important structural features of the molecules.

A 6.6 metre vacuum ultraviolet spectrograph with extremely high resolution will be used to study (a) photopredissociation processes in N2 by examination of the VUV absorption and emission spectra of nitrogen isomers, and (b) the spectroscopy of van der Waals molecules which possess laser potential in the VUV and UV regions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of
Scientific Research

8.0012, PARTICLE THEORY

R. Arnowitt, Northeastern University, School of Liberal Arts, Dept. of Physics, *360 Huntington Ave., Boston, Massachusetts* 02115 (PHY80-08333)

This work is in the area of Theoretical Physics and concentrate on aspects of gauge theories of the interactions of elementary particles. Specific topics of research include: (1) the quantum chromodynamic gauge theory of strong interactions and efforts to unify it with the Glashow-Weinberg-Salam electro-weak theory, and (2) gauge theories based on supersymmetry which attempt to include gravitation into the unification. This represents an extension and continuation of work previously supported under NSF grant PHY78-09613A01.

This is the first and second years of a three year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0013, INVESTIGATION OF THICK REFLECTION HOLOGRAMS

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AF function - future Air Force weapons systems will require the real-time processing of data obtained from a multitude of sensors at data rates which exceed current capabilities. The most promising solution at the present time is the use of the parallel processing capability of optics. Opportunity - optical processors currently require complex lenses which are heavy, bulky, and expensive. The proposed effort will investigate holographic optical elements (HOES) which offer advantages of a reduction in the mechanical stability problems of conventional optical systems, a reduction in the number of optical elements, and a reduction in weight, size, and cost, all of which render these elements very applicable to the development of optical systems for aircraft and missiles. Objective - this research will formulate both a comprehensive exposure model of dichromated gelatin holograms and theoretical techniques capable of describing the behavior of practical thick holograms. How work contributes - this effort advances optical processors for airborne and terminal guidance applications.

Theoretical techniques will be formulated including important fringe parameters of thick reflection holograms. The thick hologram equations will be formulated by two different approaches - thin grating decomposition and differential coupled-wave and the results will be compared. Novel techniques for producing holograms with desirable fringe structures will be investigated, and specific holographic optical elements will be designed, fabricated, and evaluated to demonstrate the accuracy of the theoretical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of
Scientific Research

8.0014, SURVEILLANCE - DISSOCIATIVE CHARGE TRANSFER EXCITATION

J.J. Leventhal, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (DN675483; N00014-76-C-0760)

Charge transfer processes occur in many gaseous lasers, in the ionosphere, and plasmas. Radiative charge transfer is an important means of producing population inversion in metal vapors. Thus, it is important to the naval areas of communications and surveillance to obtain a better understanding to the mechanisms involved in charge transfer excitation of metal vapors which have potential laser application.

The present apparatus is being modified so that VUV and soft x-rays can be observed. Then collisions of He(2 plus) with Li will be studied. It has been predicted theoretically that this should lead to a selective population of the He plus(31) states. Collisions between other low z ions and Li will also be studied if time permits.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0015, OBSERVATIONAL AND THEORETICAL STUDIES OF HERBIG-HARO OBJECTS

R.D. Schwartz, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (AST79-02787 A01)

A basic problem in star formation is the manner in which angular momentum is transferred outward from the protostar. It is possible that part of this angular momentum transport is done with the aid of some type of stellar wind. In present regions of star formation, the effects of such strong winds can be seen in the production of peculiar nebulae called Herbig-Haro objects. Studies of these nebulae have revealed important physical details regarding the properties of the strong mass flows. This research will involve observations at long infrared wavelengths in order to make realistic estimates of the intrinsic luminosities of stars associated with the Herbig-Haro nebulae. This is an important parameter in understanding the production of a stellar wind. The observational work will also involve detailed two-dimensional spectroscopy of the Herbig-Haro nebulae to study their dynamic structure in response to the passage of fluctuating stellar winds. An important result of this project will be a more complete understanding of some of the processes which operated in the formation of our own Solar System.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0016, GEOSYNCHRONOUS ORBIT CORRELATIVE STUDIES

R.L. Arnoldy, University System of New Hampshire, University of New Hampshire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM79-20484)

This grant will support an attempt to correlate the data received from the University of New Hampshire low energy particle experiment aboard the geosychronous satellite ATS-6 with other IMS measurements. The foot print of the satellite lies approximately at the intersection of the Alberta and East-West magnetometer chains and between the Alaskan and Fort Churchill chains offering an excellent opportunity to relate geostationary particle events with ground data. In addition, during the latter half of 1977, ATS-6 passed very close to the IMS GEOS-1 spacecraft when it was at its western apogee over Alaska. The last half of 1977 was a moderately active period including observations of the important boundaries that occur near the geostationary orbit, e.g., the plasma sheet inner edge, the injection boundary, and the magnetopause. For dynamic temporal events, such studies can contribute to our understanding of the relative roles played by local acceleration and boundary motions. In the case of steady spatial structures, radial as well as azimuthal variations may be observed so that the boundaries can be observed as at least two-dimensional objects. On alternate passes at eastern apogee, GEOS-1 made measurements near the ATS-6 orbit on the dayside while ATS-6 was observing evening injection events, thus creating the possibility of studying injection related temporal effects having a magnetospheric spatial scale.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0017, MEASUREMENTS OF THE 1-15 MEV EXTRATERRESTRIAL GAMMA-RAYS AND THE 3-70 MeV ATMOSPHERIC NEUTRONS

J.A. Lockwood, University System of New Hampshire, University of New Hampshire, School of Engineering & Physical Sciences, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM78-09702)

This grant will support balloon flights of a new University of New Hamsphire (UNH) neutron and gamma-ray (n-gamma) detector capable of measuring the fluxes, energy spectra, and angular distributions of neutrons and gamma-rays in the energy intervals from 3 MeV to 70 MeV and 1 MeV to 15 MeV respectively. The new system is a modification of the UNH n-gamma detector previously flown. The detector consists of two banks of scintillators separated by 1.2 m with a time-of-flight (TOF) system between the two banks. The upper detector consists of twelve NE 213 liquid scintillators each 7.5 cm x 7.5 cm in size. The lower bank has ten 12.5 cm x 5 cm sodium iodide scintillators and six scintillators. The pulse shape discrimination (PSD) in each scintillator cell separates the protons and alphas produced by neutrons from the electrons produced by gamma-ray interactions. Pulse height analysis on each interaction coupled with TOF measurements enables the direction and energies of neutrons and gamma-rays to be determined. The two detector banks are separately enclosed in anti-coincidence charged particle shields.

The flights will produce: (1) a measurement of the diffuse cosmic gamma-ray flux from 1-15 MeV; (2) upper limits on discrete gamma-ray sources in the 1-15 MeV energy range; (3) accurate atmospheric gamma-ray flux values; (4) angular distributions of neutrons from 3-70 MeV at the top of the atmosphere; and (5) the neutron energy spectrum from 3-70 MeV.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0018, PHOTOSYNTHETIC PROCESS PROBED DIRECTLY WITH PICOSECOND LASER PULSES

R.R. Alfano, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (PCM77-14966 A04)

The understanding of the primary processes in photosynthesis has benefited greatly from direct picosecond kinetics measurements and studies in the picosecond fluorescence kinetics have opened a new era in photosynthesis research. Principally this project encompasses the systematic time dependent study of the kinetics, spectrum, and polarization of the subnanosecond fluorescent emmission and absorption difference from photosynthetic systems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

8.0019, SEMICONDUCTORS INVESTIGATED BY TIME-RESOLVED RAMAN, ABSORPTION AND PHOTOLUMINESCENCE SPECTROSCOPY

R.R. Alfano, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DF057430; AFOSR-80-0079)

Microwave solid state electronic devices are essential components of Air Force surveillance, electronic conuntermeasures and communications systems. Many electrical, optical and thermal properties of semiconductors are ultimately determined by the underlying physical phenomena produced by the interac-

tions among and between electrons, phenons, excitons, plasmons, and other elementary excitations. Most microscopic processes involving these excitations occur on a picosecond time scale. The opportunity now exists to directly investigate relaxation kinetics in optical materials. Objective - to construct a femtosecond laser spectroscopy system and to study the underlying physical transient phenomena that occur in semiconductors and extract fundamental information on electron and phenon transport.

Picosecond and subpicosecond time resolved spectroscopy and time resolved raman, absorption and photoluminescence will be used to investigate intervalley and intravalley scattering rates, thermalization rates, and the transient development of the electron distribution function of photogenerated carriers as function of temperature. The optical phenon lifetimes will be directly measured as a function of temperature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0020, THEORY OF PHYSICAL RESPONSE FUNCTIONS IN SYSTEMS WITH BROKEN SYMMETRY, SUCH AS AMORPHOUS SOLIDS
J.L. Birman, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (INT79-18591)

This award will support Professor Joseph Birman of the City University of New York for a period of two years in a program of cooperative research with Professor Takao Matsubara of Kyoto University in Japan for the purpose of studying physical response functions for condensed matter systems with broken symmetry, a topic of current high interest in solid state physics.

Particular emphasis will be given to amorphous tetrahedral semiconductors, systems of intrinsic scientific as well as potential applied interest. The investigators will utilize the complementary expertise of Dr. Birman in group theory applications and Dr. Matsubara in many-body theory. This project is sponsored jointly by NSF and by the Japan Society for the Promotion of Science under the U. S.-Japan Cooperative Science Program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0021, A STUDY OF HOMOGENEOUS STEADY STATE PLASMS IN RF ELECTROMAGNETIC FIELDS
H.H. Brown, New York University, Washington Square & University College of Arts & Sciences, Dept. of Physics, *421 1st Ave., New York, New York* 10012 (PHY80-08002)

The properties and construction of a new type of plasma apparatus is described, as well as experiments to be performed with it. A surface ionized Ba plasma is contained in a 2500 degrees K refractory metal microwave cavity. The interaction studies is that between microwave fields and plasmas, but the microwave system also serves as a diagnostic. A tuneable dye laser beam traversing the cavity provides highly localized measurements of ion densities and motions by use of resonant fluorescent techniques. Proposed areas of research include pondermotive force effects, non-linear dielectric properties, electron-ion collision frequencies, and instabilities.

This is the first year of a two-year continuing grant, previously supported under NSF grant PHY77-26928.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, DEFECTS IN SEMICONDUCTORS
J.W. Corbett, State University of New York, Albany Campus, School of Arts & Sciences, Dept. of Physics, *1400 Washington Ave., Albany, New York* 12222 (DN123026; N00014-75-C-0919)

Studies of defects in semiconductors, defects produced by radiation or by ion implantation of foreign species are of great importance to a broad spectrum of Navy electronics systems. Radiation effects studies support nuclear radiation vulnerability programs and ion implantation studies support new material and electron device technology.

The investigator combines a variety of theoretical and experimental techniques for identifying defects in semiconductors and understanding their affect on material properties. EPR, ENDOR, transient capacitance, Rutherford backscattering, channeling, and optical measurement techniques are used. Current efforts include studies of hydrogen related defects in silicon, and studies of lithium, boron, and gold related defects. Another problem area is the relationship of oxygen impurities and heat treatment on the defect nature of silicon. Recently, interest has risen on the problem of impurities related to dislocations and these will be studied. The renormalization group technique will be applied to the theory of defects. Studies will be made on nature of defects in laser annealed semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0023, MICROWAVE INVESTIGATIONS OF MATTER 14150-P
W. Gordy, Duke University, Trinity College of Arts & Sciences, Dept. of Physics, *Durham, North Carolina* 27706 (DA0E9252; DAAG29 77 G0007)

To gain information about the structure and properties of molecules and to develop further the instruments and techniques for generating, detecting and measuring coherent submillimeter wave radiation. Relevance: The program is fundamental to the understanding of laser excited states in gases that operate in the submillimeter region. Consequently, the research is relevant to long term Army interest in developing millimeter and submillimeter technology for remote sensing.

(1) Continue development of molecular beam maser to higher frequencies using low rotational transitions of simple molecules in the ground vibrational state. (2) Observe rotational transitions of excited vibrational states during pulsed and CW operation as submillimeter lasers. (3) Attempt observation of 'forbidden' transitions of certain symmetric top molecules and non-polar diatomic molecules. (4) Study of rotational spectra of excited vibrational states in simple diatomic and triatomic molecules which vaporize at room temperature. (5) Study unstable molecular species having unpaired electrons. (6) Develop sensitive detectors and harmonic generators for submillimeter operation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0024, DEFINITION OF PHYSICS AND CHEMISTRY EXPERIMENTS IN SPACE
Unknown, U.S. National Aeronautics & Space Admin., Lewis Research Center, *21000 Brookpark Rd., Cleveland, Ohio* 44135 (506-56-22)

This effort is to conduct definition studies for potential Spacelab experiments which support, complement, or proceed from OAST research and technology programs, specifically to determine the technical and programmatic requirements for the experiment effort. Definition studies will be carried out in fluid physics on mass transfer, bubble motion, fluid surface dynamics and capillarity, convection phenomena, and multiphase mixtures. In combustion, studies will be pursued in premixed gaseous combustion, gas jet combustion, droplet and particle combustion, large surface liquid and solid combustion, combustion of particle clouds, ignition and autoignition, extinguishment, and gravitational scaling.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0025, POINT DEFECTS IN INSULATING SOLIDS
F.J. Feigl, Lehigh University, School of Arts & Sciences, Dept. of Physics, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DN923173; N00014-76-C-0125)

This research investigates the nature of point defects in quartz and amorphous-silicon-dioxide thin films, which will improve our understanding of these films utilized in metal-oxide-semiconductor devices found in naval electronics systems.

Theoretical calculations will be made on the electronic structure of silicon dioxide to achieve better understanding and correlation with experimental measurements. Models for hole types in silicon dioxide will be investigated. A program for chemical characterization of the silicon-silicon dioxide interface will be started.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0026, INVERSE SCATTERING - IONOSPHERIC STRUCTURE DETERMINATION

J.M. Cohen, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DF055770; F49620-79-C-0127)

AF function - radio communication and control. Opportunity - a newly developed method for data processing seems applicable to ionospheric probing. Objective - real time measurement of F layer irregularities. How work contributes - layering characteristics of ionosphere will aid development of optimized modulation and diversity schemes for propagating radio waves.

Present ray based algorithms for ionospheric probing give approximate information only about the near side of peaks in index of refraction. Newly developed wave based inverse scattering techniques seem capable of determining the far side of the peak as well. Amplitude and phase data versus frequency for vertical propagation will be obtained on a quiet day near the magnetic equator. A definite variational principle for the Gelfand-Levitan equation will be used to construct and obtain error bounds for the variation of index refraction in the F layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0027, DEVICE-RELATED STUDIES OF A NEW EFFECT OF CHARGE STORAGE AND RELEASE IN SEMICONDUCTORSS

D.D. Coon, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (ECS79-16441)

A new effect involving charge storage and release in semiconductors is under investigation. The effect has been studied in Si:P at temperatures below 24 degrees K, Ge:Sb at T less than 7 degrees K, and SiC:H at T less than 350 degrees K. Theoretical work indicates that field ionization of impurity atoms by quantum mechanical tunnelling can explain the observed release of charge at low temperatures. Charge storage is accomplished via capture of injected or photoexcited carriers by ionized impurity atoms. Calculations indicate that with modest voltage swings the lifetime of stored charge can be changed from indefinitely long periods to times in the nanosecond to picosecond range. Experimentally, lifetimes ranging from much greater than 2 days to less than 0.3 nanoseconds are observed. Factors that are relevant to the characterization of electronic and optoelectronic devices that utilize the effect, such as the maximum attainable speed, the maximum operating temperature, sensitivity in the infrared and visible regions, and limitations on scaling down device size are under investigation. Device calculations are performed in parallel with experimental work to establish a quantitative description of device operation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

8.0028, COLLISIONS INVOLVING ATOMS IN HIGH RYDBERG STATES

R.F. Stebbings, Rice University, Graduate School, Dept. of Physics, *6100 Main St., Houston, Texas* 77001 (PHY78-09860)

Research will continue on the structure and properties of very highly excited ('Rydberg') atoms. Topics to be pursued include: 1. Thermal collisions with atoms and molecules; 2. Collisions with low-energy electrons; 3. Field ionization; 4. Production of Rydberg atoms; 5. Excitation transfer; 6. Chemiionization.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0029, PROPERTIES OF LIQUID HELIUM FOUR

G.B. Hess, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-10778)

By studying the amplitude dependence of the resonant frequency of a Helmholtz resonator in the regime of vortex-free superfluid flow, the experimental observation has been made of the dependence of the superfluid density on the difference between the superfluid and normal fluid velocity. A systematic study of this dependence will be made, with emphasis on the region near the transition temperature where there are problems with the theory of the superfluid density. This work is important for understanding the hydrodynamics of quantum fluids.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, CONTINUED DEVELOPMENT OF SPATIAL INTERFEROMETRY AT INFRARED WAVELENGTHS

F.J. Low, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (AST79-02869 A01)

High angular resolution at infrared wavelengths can yield important data on mass loss in the later stages of stellar evolution and the formation of stars, hidden from optical observers by the clouds of dust and gas in which star formation occurs. Infrared spatial interferometry when coupled with the Multiple Mirror Telescope shows great promise of being a practical technique to realize the high resolution. Further investigation and refinement of this technique will be supported, and a powerful new interferometer designed to make use of the unique features of the Multiple Mirror Telescope will be constructed. This is the second year of a two year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, CCD CAMERA DEVELOPMENT FOR ASTRONOMICAL INSTRUMENTATION

H.S. Stockman, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (AST79-23954)

Two cameras utilizing CCD chips as detectors will be built and tested for use on the Steward Observatory 1.6 meter on Mt. Lemmon, the 2.3 meter on Kitt Peak and the MMT on Mt. Hopkins. The superb quantum efficiency of these new detectors will effectively increase the aperture of these telescopes by many times. The tests will be thorough and the results will be communicated to the rest of the community. The new cameras will find extensive use in programs of both direct imaging and spectroscopy of quasars, infrared sources, nova shells and degenerate stars. A solid base of experience about the usefulness of these promising new detectors to astronomy will result.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0003, RELATIVISTIC ASTROPHYSICS

K.S. Thorne, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST79-22012)

This proposal covers research in many different areas of relativistic astrophysics. The research will primarily be theoreti-

cal; but it will include a modest amount of astronomical observations, and much close interaction with observational astronomers and with experimenters who are attempting to detect cosmic gravitational waves. The topics to be studied include, among others: (A) the large-scale structure and cosmological evolution of the universe; (B) the origin, structure, and evolution of galaxies, clusters of galaxies, and quasars; (C) the dynamics of globular clusters and the distribution of masses for their stars, which presumably are the oldest stars in the universe; (D) accretion disks around black holes, and their possible roles in quasars and in compact x-ray sources; (E) close binary star systems, their roles as compact x-ray sources, and models to explain the observed features of their X-ray and optical emissions; (F) the theory of the generation of gravitational waves, and estimates of the gravitational waves which bathe the Earth; (G) theoretical analyses of and design studies for gravitational-wave detectors, with emphasis on quantum mechanical limits to their performance and on quantum-electronics techniques for circumventing those limits.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0004, RADIO STUDIES OF QSO'S AND RELATED OBJECTS

T.W. Jones, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics/Astronomy, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (AST79-00304)

A coordinated research effort to examine the radio to optical polarization properties and the radio structure of a variety of compact nonthermal sources, in order to help define the physical conditions in such sources, and to better establish the relationships between the different spectral regions and different types of sources.

Three related programs are described. In the first, a sample of QSO's and BL Lac Objects are being studied through simultaneous polarimetry obtained in the centimeter, millimeter, infrared and optical wavelength regions. The second program involves a Very Long Baseline Interferometric (VLBI) study of many of the same sources (most not previously studied) in order to begin sorting out the origins of the remarkably flat radio spectra exhibited by these objects and to look for correlations between radio structure and polarization. The third approach to these problems is through the spectral and polarization study of compact nuclear sources in radio galaxies, which may be lower liminosity manifestations of the QSO phenomenon.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, A CCD CAMERA FOR ASTRONOMICAL RESEARCH

D.G. York, Princeton University, School of Natural Sciences, Dept. of Astrophysical Sciences, *Box 430, Princeton, New Jersey* 08540 (AST79-20394)

York and the Princeton detector group will capitalize on newly available CCD chips and their experience to construct a detector system which can be easily transported and mated to existing optical equipment. They will use the high quantum efficiency and low readout noise which they propose to achieve to provide speed gain of up to a factor of 10 over the current methods. They will use the new camera in the detection of galactic halos, imaging of high velocity clouds in supernova remnants, and various spectroscopic studies of distant galaxies and quasi-stellar objects. The camera will be fully documented and built of commercially available parts where possible to facilitate its reproduction by other researchers.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

GENERAL

11.0001, SPACE SYSTEMS AND PLANNING ANALYSIS

Unknown, U.S. National Aeronautics & Space Admin., *600 Independence Ave. S.W., Washington, District of Columbia* 20553 (540-04-10)

The objective of this RTOP is to provide space program planning studies in support of OAST technology program requirements, assessments, planning, and advocacy. The studies are intended to provide an analytical basis for planning activities in space R&T. Areas of work will include technology status and trends assessments; mission concepts and systems; long-range planning activities; program technology needs, requirements and opportunities. The major focus of this activity is the NASA Space System's Technology Model, including its completion and maintenance.

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01 AERONAUTICS (GENERAL)

N81-17981*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC CRUISE RESEARCH 1979, PART 1
Mar. 1980 542 p refs Conf. held at Hampton, Va., 13-16 Nov. 1979 2 Vol.
(NASA-CP-2108-Pt-1; L-13385) Avail: NTIS HC A23/MF A01 CSCL 01A

Aerodynamics, stability and control, propulsion, and environmental factors of the supersonic cruise aircraft are discussed. Other topics include airframe structures and materials, systems integration, and economics. For individual titles, see N81-17982 through N81-18004.

N81-17982*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OVERVIEW OF THE LANGLEY SUBSONIC RESEARCH EFFORT ON SCR CONFIGURATION
Paul L. Coe, Jr., James D. Thomas, Jarrett K. Huffman, Robert P. Weston, Ward E. Schoonover, Jr., and Carl L. Gentry, Jr. *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 13-33 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

Recent advances achieved in the subsonic aerodynamics of low aspect ratio, highly swept wing designs are summarized. The most significant of these advances was the development of leading edge deflection concepts which effectively reduce leading edge flow separation. The improved flow attachment results in substantial improvements in low speed performance, significant delay of longitudinal pitch up, increased trailing edge flap effectiveness, and increased lateral control capability. Various additional theoretical and/or experimental studies are considered which, in conjunction with the leading edge deflection studies, form the basis for future subsonic research effort. E.D.K.

N81-17983*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RESULTS OF A LOW-SPEED WIND TUNNEL TEST OF THE MDC 2.2M SUPERSONIC CRUISE AIRCRAFT CONFIGURATION **c02**
L. P. Yip, L. P. Parlett, R. L. Roensch, J. E. Felix, and H. R. Welge *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 35-57 refs Prepared in cooperation with Douglas Aircraft Co., Long Beach, Calif. (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

Results of a low speed test conducted in the Full Scale Tunnel at NASA Langley using an advanced supersonic cruise vehicle configuration are presented. These tests used a 10 percent scale model of a configuration that had demonstrated high aerodynamic performance at Mach 2.2 during a previous test program. The low speed model has leading and trailing edge flaps designed to improve low speed lift to drag ratios at high lift and includes devices for longitudinal and lateral/directional control. The results obtained during the low speed test program have shown that full span leading edge flaps are required for maximum performance. The amount of deflection of the leading edge flap must increase with C sub L to obtain the maximum benefit. Over 80 percent of full leading edge suction was obtained up to lift off C sub L's of 0.65. A mild pitch up occurred at about 6 deg angle of attack with and without the leading edge flap deflected. The pitch up is controllable with the horizontal tail. Spoilers were found to be preferable to spoiler/deflectors at low speeds. The vertical tail maintained effectiveness up to the highest angle of attack tested but the tail on directional stability deteriorated at high angles of attack. Lateral control was adequate for landing at 72 m/sec in a 15.4 m/sec crosswind. E.D.K.

N81-17984*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE PREDICTION OF PRESSURE DISTRIBUTIONS ON AN ARROW-WING CONFIGURATION INCLUDING THE EFFECT OF CAMBER, TWIST, AND A WING FIN **c02**
Percy J. Bobbitt, Marjorie E. Manro, and Robert M. Kulfan *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 59-115 refs Prepared in cooperation with the Boeing Commercial Airplane Co., Seattle (For primary document see N81-17981 09-01)
(Contracts NAS1-12875; NAS1-4141; NAS1-14962; NAS1-15678)
Avail: NTIS HC A23/MF A01 CSCL 01A

Wind tunnel tests of an arrow wing body configuration consisting of flat, twisted, and cambered twisted wings were conducted at Mach numbers from 0.40 to 2.50 to provide an experimental data base for comparison with theoretical methods. A variety of leading and trailing edge control surface deflections were included in these tests, and in addition, the cambered twisted wing was tested with an outboard vertical fin to determine its effect on wing and control surface loads. Theory experiment comparisons show that current state of the art linear and nonlinear attached flow methods were adequate at small angles of attack typical of cruise conditions. The incremental effects of outboard fin, wing twist, and wing camber are most accurately predicted by the advanced panel method PANAIR. Results of the advanced panel separated flow method, obtained with an early version of the program, show promise that accurate detailed pressure predictions may soon be possible for an aeroelasticity deformed wing at high angles of attack. E.D.K.

N81-17985*# Old Dominion Univ., Norfolk, Va.
EXPLORATORY SUBSONIC INVESTIGATION OF VORTEX-FLAP CONCEPT ON ARROW WING CONFIGURATION **c02**
Dhanvada M. Rao *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1981 p 117-129 refs (For primary document see N81-17981 09-01)
(Contract NsG-1315)
Avail: NTIS HC A23/MF A01 CSCL 01A

The drag reduction potential of a vortex flap concept, utilizing the thrust contribution of separation vortices maintained over leading edge flap surfaces, was explored in subsonic wind tunnel tests on a highly swept arrow wing configuration. Several

flap geometries were tested in comparison with a previous study on the same model with leading edges drooped for attached flow. The most promising vortex flap arrangements produced drag reductions comparable with leading edge droop over a range of lift coefficients from 0.3 to 0.6 (untrimmed), and also indicated beneficial effects in the longitudinal and lateral static stability characteristics. E.D.K.

N81-17986*# Boeing Commercial Airplane Co., Seattle, Wash.
WIND TUNNEL TEST RESULTS OF A NEW LEADING EDGE FLAP DESIGN FOR HIGHLY SWEPT WINGS, A VORTEX FLAP **c02**

L. James Runyan, Wilbur D. Middleton, and John A. Paulson *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 131-147 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

A leading edge flap design for highly swept wings, called a vortex flap, was tested on an arrow wing model in a low speed wind tunnel. A vortex flap differs from a conventional plain flap in that it has a leading edge tab which is counterdeflected from the main portion of the flap. This results in intentional separation at the flap leading edge, causing a vortex to form and lie on the flap. By trapping this vortex, the vortex flap can result in significantly improved wing flow characteristics relative to conventional flaps at moderate to high angles of attack, as demonstrated by the flow visualization results of this tests. E.D.K.

N81-17987*# Rockwell International Corp., Thousand Oaks, Calif. North American Aircraft Div.
A STUDY OF WING BODY BLENDING FOR AN ADVANCED SUPERSONIC TRANSPORT **c05**

T. P. Goebel, E. Bonner, and D. A. Robinson *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 149-169 refs (For primary document see N81-17981 09-01)
(Contract NAS1-15720)
Avail: NTIS HC A23/MF A01 CSCL 01C

Increases in supersonic cruise lift drag ratio were sought at Mach numbers 2.2 and 2.7 using wing body planform and thickness blending. Constrained twist and camber optimization was performed in the presence of nacelles. Wing and fuselage thickness distributions were optimized for either minimum volume wave drag or minimum total pressure wave drag. The zero leading edge suction lift drag ratios were determined for three wing planforms. The magnitude of the effect of leading edge suction on attainable lift drag ratio was defined on one planform and estimation of available leading edge suction was made. Author

N81-17988*# Boeing Commercial Airplane Co., Seattle, Wash.
PREDICTION OF NACELLE AERODYNAMIC INTERFERENCE EFFECTS AT LOW SUPERSONIC MACH NUMBERS **c02**

Robert M. Kulfan *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 171-203 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

The accuracy of analytical predictions of nacelle aerodynamic interference effects at low supersonic speeds are studied by means of test versus theory comparisons. Comparisons shown include: (1) isolated wing body lift, drag, and pitching moments; (2) isolated nacelle drag and pressure distributions; (3) nacelle interference shock wave patterns and pressure distributions on the wing lower surface; (4) nacelle interference effects on wing body lift, drag, and pitching moments; and (5) total installed nacelle interference effects on lift, drag, and pitching moment. The comparisons also illustrate effects of nacelle location, nacelle spillage, angle of attack, and Mach numbers on the aerodynamic interference. The initial results seem to indicate that the methods can satisfactorily predict lift, drag, pitching moment, and pressure distributions of installed engine nacelles at low supersonic Mach numbers with mass flow ratios from 0.7 to 1.0 for configurations typical of efficient supersonic cruise airplanes. E.D.K.

N81-17989*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ANALYTIC DEVELOPMENT OF IMPROVED SUPERSONIC CRUISE AIRCRAFT BASED ON WIND TUNNEL DATA **c05**

R. L. Roensch and G. S. Page *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 205-227 refs (For primary document see N81-17981 09-01)
(Contract NAS1-14621)
Avail: NTIS HC A23/MF A01 CSCL 01C

Data obtained from the MDC/NASA cooperative wing tunnel program were used to develop empirical corrections to theory. These methods were then used to develop a 2.2M supersonic cruise aircraft configuration with a cruise trimmed maximum L/D of 10.2. The empirical corrections to the theory are reviewed, and the configuration alternatives examined in the development of the configuration are presented. The benefits of designing for optimum trimmed performance, including the effects of the nacelles, are discussed. Author

N81-17990*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC WINGS WITH SIGNIFICANT LEADING-EDGE THRUST AT CRUISE **c05**

A. Warner Robins, Harry W. Carlson, and Robert J. Mack *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 229-246 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

Experimental/theoretical correlations are presented which show that significant levels of leading edge thrust are possible at supersonic speeds for certain planforms which match the theoretical thrust distribution potential with the supporting airfoil geometry. The analytical process employed spanwise distribution of both it and/or that component of full theoretical thrust which acts as vortex lift. Significantly improved aerodynamic performance in the moderate supersonic speed regime is indicated. Author

N81-17991*# Calspan Advanced Technology Center, Buffalo, N.Y.
FLYING QUALITIES DESIGN CRITERIA APPLICABLE TO SUPERSONIC CRUISE AIRCRAFT **c05**

Charles R. Chalk *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 251-267 refs (For primary document see N81-17981 09-01)
(Contract F33615-78-C-3602)
Avail: NTIS HC A23/MF A01 CSCL 01C

A comprehensive set of flying qualities design criteria was prepared for use in the supersonic cruise research program. The framework for stating the design criteria is established and design criteria are included which address specific failures, approach to dangerous flight conditions, flight at high angle of attack, longitudinal and lateral directional stability and control, the primary flight control system, and secondary flight controls. Examples are given of lateral directional design criteria limiting lateral accelerations at the cockpit, time to roll through 30 deg of bank, and time delay in the pilot's command path. Flight test data from the Concorde certification program are used to substantiate a number of the proposed design criteria. E.D.K.

N81-17992*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ADVANCED SUPERSONIC TRANSPORT FIXED-BASE SIMULATOR EVALUATIONS AT LANDING APPROACH **c09**

John B. Feather *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 269-283 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 14B

Equations of motion simulating the landing approach case for the supersonic cruise vehicle were programmed and exercised using a fixed base simulation facility. Unaugmented and augmented system comparisons using this facility are provided. Refinements necessary for system performance improvement are made. The unaugmented longitudinal responses to elevator commands are slow and sluggish, requiring augmentation to increase the speed of the response. In the lateral directional case, the Dutch roll is highly underdamped and requires an augmentation system to increase this damping and provide satisfactory flying qualities. The status of this fixed base study is that the longitudinal equations, updated with recent wind tunnel data, were evaluated on the simulator and the system found to be satisfactory. The lateral axis equations are linearized and are not yet updated to large excursion capability; consequently, only limited, preliminary findings on this system are available. The

basic results so far indicate augmentation systems are required to provide a satisfactory longitudinal system, and that additional study and evaluation of the lateral directional case are necessary before a more complete assessment can be made. E.D.K.

N81-17993*# Lockheed-California Co., Burbank.
SIMULATOR INVESTIGATION OF ARROW-WING LOW-SPEED HANDLING QUALITIES **c09**
Ben T. Averett *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 285-298 ref (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 14B

Low speed handling qualities of arrow wings were investigated with a piloted simulator. Existing aerodynamic data were used from NASA SCAT 15F tunnel tests augmented with Lockheed low speed wind tunnel test data. Two arrow wing planforms were chosen for the simulation effort a Mach 2.0 design and a Mach 2.7 design. These designs are in the SCAT 15F Mach 2.7 design family, having the same beta AR and beta cot lambda. Piloted simulation results indicate that both the Mach 2.0 and Mach 2.7 planforms have satisfactory longitudinal flying qualities. However, in the control of bank angle the Mach 2.0 planform demonstrates satisfactory handling qualities while the Mach 2.7 planform is unacceptable. This situation applies for crosswind landings at FAA limits and for lineup in heavy turbulence. The low speed superiority of the Mach 2 planform with its lower sweep and higher aspect ratio is also shown by its ability to approach at least 8 m/s slower than the Mach 2.7 planform without degradation in handling qualities. Author

N81-17994*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF SCR AIRCRAFT TAKEOFF AND LANDING PROCEDURES FOR COMMUNITY NOISE ABATEMENT AND THEIR IMPACT ON FLIGHT SAFETY **c03**
William D. Grantham and Paul M. Smith (Kentron International, Inc.) *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 299-333 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

Piloted simulator studies to determine takeoff and landing procedures for a supersonic cruise transport concept that result in predicted community noise levels which meet current Federal Aviation Administration (FAA) standards are discussed. The results indicate that with the use of advanced procedures, the subject simulated aircraft meets the FAA traded noise levels during takeoff and landing utilizing average flight crew skills. The advanced takeoff procedures developed involved violating three of the current Federal Aviation Regulations (FAR) noise test conditions. These were: (1) thrust cutbacks at altitudes below 214 meters (700 ft); (2) thrust cutback level below those presently allowed; and (3) configuration change, other than raising the landing gear. It was not necessary to violate any FAR noise test conditions during landing approach. It was determined that the advanced procedures developed do not compromise flight safety. Automation of some of the aircraft functions reduced pilot workload, and the development of a simple head-up display to assist in the takeoff flight mode proved to be adequate. M.G.

N81-17995*# General Electric Co., Lynn, Mass.
VCE TEST BED ENGINE FOR SUPERSONIC CRUISE RESEARCH **c07**
J. W. Vdoviak and J. A. Ebacher *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 347-356 (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 21E

Various design concepts for a variable cycle engine applicable to a supersonic, mixed mission propulsion system which would combine the merits of a turbofan at subsonic operating conditions with those of a turbojet for supersonic operating conditions are briefly examined. In particular the integration of the variable area bypass injector with the core driven (aft fan block) fan stage is discussed and the technical benefits of the configuration are summarized. M.G.

N81-17996*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
VARIABLE STREAM CONTROL ENGINE FOR ADVANCED SUPERSONIC AIRCRAFT DESIGN UPDATE **c07**
Richard B. Hunt and Robert A. Howlett *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 347-370 refs (For primary document see N81-17981 09-01)
(Contract NAS3-21389)
Avail: NTIS HC A23/MF A01 CSCL 21E

The updating of the engine concept for a second-generation supersonic transport, the variable stream control engine (VSCE), in terms of mechanical design definition and estimated performance is discussed. The design definition reflects technology advancements that improve system efficiency, durability and environments were established. The components unique to the VSCE concept, a high performance duct burner and a low noise coannular nozzle, and the high temperature components are identified as critical technologies. Technology advances for the high temperature components (main combustor and turbines) are also discussed. To address the requirements in this area, the technical approach for undertaking a high temperature validation program is defined. The multi-phased effort would include assorted rig and laboratory tests, then culminate with the demonstration of a flight-type main combustor and single-stage high pressure turbine at operating conditions envisioned for a VSCE. M.G.

N81-17997*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
PROGRESS WITH VARIABLE CYCLE ENGINES **c07**
John S. Westmoreland *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 371-390 refs (For primary document see N81-17981 09-01)
(Contracts NAS3-20048; NAS3-20061; NAS3-20602)
Avail: NTIS HC A23/MF A01 CSCL 21E

The evaluation of components of an advanced propulsion system for a future supersonic cruise vehicle is discussed. These components, a high performance duct burner for thrust augmentation and a low jet noise coannular exhaust nozzle, are part of the variable stream control engine. An experimental test program involving both isolated component and complete engine tests was conducted for the high performance, low emissions duct burner with excellent results. Nozzle model tests were completed which substantiate the inherent jet noise benefit associated with the unique velocity profile possible of a coannular exhaust nozzle system on a variable stream control engine. Additional nozzle model performance tests have established high thrust efficiency levels at takeoff and supersonic cruise for this nozzle system. Large scale testing of these two critical components is conducted using an F100 engine as the testbed for simulating the variable stream control engine. M.G.

N81-17998*# Lockheed-California Co., Burbank.
EFFECTS ON INLET TECHNOLOGY ON CRUISE SPEED SELECTION **c05**
L. H. Bangert, D. M. Santman, G. Horie, and L. D. Miller *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 391-411 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

The impact of cruise speed on technology level for certain aircraft components is examined. External-compression inlets were compared with mixed compression, self starting inlets at cruise Mach numbers of 2.0 and 2.3. Inlet engine combinations that provided the greatest aircraft range were identified. Results show that increased transonic to cruise corrected air flow ratio gives decreased range for missions dominated by supersonic cruise. It is also found important that inlets be designed to minimize spillage drag at subsonic cruise, because of the need for efficient performance for overland operations. The external compression inlet emerged as the probable first choice at Mach 2.0, while the self starting inlet was the probable first choice at Mach 2.3. Airframe propulsion system interference effects were significant, and further study is needed to assess the existing design methods and to develop improvements. M.G.

N81-17999*# General Electric Co., Cincinnati, Ohio.
VCE EARLY ACOUSTIC TEST RESULTS OF GENERAL ELECTRIC'S HIGH-RADIUS RATIO COANNULAR PLUG NOZZLE **c71**

Paul R. Knott, J. F. Brausch, P. K. Bhutiani, R. K. Majjigi, and V. L. Doyle *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 417-452 refs (For primary document see N81-17981 09-01)
(Contracts NAS3-20582; NAS3-21608)
Avail: NTIS HC A23/MF A01 CSCL 20A

Results of variable cycle engine (VCE) early acoustic engine *and model scale tests are presented. A summary of an extensive* series of far field acoustic, advanced acoustic, and exhaust plume velocity measurements with a laser velocimeter of inverted velocity and temperature profile, high radius ratio coannular plug nozzles on a YJ101 VCE static engine test vehicle are reviewed. Select model scale simulated flight acoustic measurements for an unsuppressed and a mechanical suppressed coannular plug nozzle are also discussed. The engine acoustic nozzle tests verify previous model scale noise reduction measurements. The engine measurements show 4 to 6 PNdB aft quadrant jet noise reduction and up to 7 PNdB forward quadrant shock noise reduction relative to a fully mixed conical nozzle at the same specific thrust and mixed pressure ratio. The influences of outer nozzle radius ratio, inner stream velocity ratio, and area ratio are discussed. Also, laser velocimeter measurements of mean velocity and turbulent velocity of the YJ101 engine are illustrated. Select model scale static and simulated flight acoustic measurements are shown which corroborate that coannular suppression is maintained in forward speed. M.G.

N81-18000*# Douglas Aircraft Co., Inc., Long Beach, Calif.
FLIGHT AND TUNNEL TEST RESULTS OF THE MDC MECHANICAL JET NOISE SUPPRESSOR NOZZLE c71
R. D. FitzSimmons, R. A. McKinnon, and E. S. Johnson *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 453-478 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 20A

The flight and wind tunnel tests to determine the acoustic and performance effects of a mechanical jet noise suppressor nozzle mounted on a Viper engine of an HS-125 airplane are discussed. Flyover noise measurements were made with microphones mounted on top of a 137.5 m bridge tower. Seven nozzle configurations including two references nozzles, two suppressors, and three ejector inlets were tested. The suppressor nozzle of interest for an advanced supersonic transport, the suppressor/treated ejector, achieved a measured noise reduction of 14 EPNdB relative to a conventional conical reference nozzle at the highest pressure ratio tested (approximately 2.5). The unique engine nacelle, flight hardware, and nacelles from the HS-125 flight test program, combined with a simulated HS-125 fuselage were windtunnel tested. Both propulsion and acoustic data were recorded. Preliminary thrust data results from the wind tunnel tests are summarized and compared to other mechanical suppressor test results. The test results indicate that a noise reduction of at least 16 EPNdB would be possible for the suppressor/ejector nozzle scaled to typical AST engine size with a 5% thrust loss at a typical takeoff climb speed. M.G.

N81-18001*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF NOZZLE DESIGN ON THE NOISE FROM SUPERSONIC JETS c71
John M. Seiner, Thomas D. Norum, and Lucio Maestrello *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 479-491 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 20A

The aeroacoustic supersonic performance of various internal nozzle geometries is evaluated for shock noise content over a wide range of nozzle pressure ratios. The noise emission of a Mach 1.5 and 2.0 convergent-divergent (C-D) nozzle is measured and compared to convergent nozzles. Comparisons are also made for a Mach 1.5 conical C-D nozzle and a porous plug nozzle. The Mach 1.5 conical C-D nozzle shows a small reduction in shock noise relative to the shock free case of the Mach 1.5 C-D nozzle. The Mach 1.5 C-D nozzle is found to have a wide operating nozzle pressure ratio range around its design point where shock noise remains unimportant compared to the jet mixing noise component. However it is found that the Mach 2 C-D nozzle shows no significant acoustic benefit relative to the convergent nozzle. Results from the porous plug nozzle indicate that shock noise may be completely eliminated, and the jet mixing noise *reduced.* *Author*

N81-18002*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF NOISE TECHNOLOGY FOR ADVANCED *SUPERSONIC CRUISE AIRCRAFT* c71
James R. Stone and Orlando A. Gutierrez *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 493-518 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 20A

Developments in acoustic technology applicable to advanced supersonic cruise aircraft, particularly those which relate to jet noise and its suppression *are reviewed. The noise reducing* potential of high radius ratio, inverted velocity profile coannular jets is demonstrated by model scale results from a wide range of nozzle geometries, including some simulated flight cases. These results were verified statistically at large scale on a variable cycle engine (VCE) testbed. A preliminary assessment of potential VCE noise sources such as fan and core noise is made, based on the testbed data. Recent advances in the understanding of flight effects are reviewed. The status of component noise prediction methods is assessed on the basis of recent test data, and the remaining problem areas are outlined. M.G.

N81-18003*# Federal Aviation Administration, Washington, D.C. Office of Environment and Energy.
ENVIRONMENTAL EFFECTS OF AN AIRCRAFT AT CRUISE: AN UPDATE c45
N. Sundararaman *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 519-534 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 13B

The status of the calculations of ozone change due to high altitude aircraft is critically reviewed and important areas of uncertainty identified. Laboratory determinations of chemical reaction rates and modeling refinements show that the effect of cruise altitude emissions on stratospheric ozone has changed from one of ozone decrease to one of slight increase. It is concluded that the uncertainties in the present understanding of the effects of high altitude aircraft are such as to warrant continued studies. M.G.

N81-18004*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED TECHNOLOGY FOR CONTROLLING POLLUTANT EMISSIONS FROM SUPERSONIC CRUISE AIRCRAFT c45
Robert A. Duerr and Larry A. Diehl *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 535-549 (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 13B

Gas turbine engine combustor technology for the reduction of pollutant emissions is summarized. Variations of conventional combustion systems and advanced combustor concepts are discussed. Projected results from far term technology efforts aimed at applying the premixed prevaporized and catalytic combustion techniques to aircraft combustion systems indicate a potential for significant reductions in pollutant emission levels. M.G.

N81-18005*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC CRUISE RESEARCH 1979, PART 2
Mar. 1980 407 p refs Conf. held at Hampton, Va., 13-16 Nov. 1979
(NASA-CP-2108-Pt-2; L-13385) Avail: NTIS HC A18/MF A01 CSCL 01A

Advances in airframe structure and materials technology for supersonic cruise aircraft are reported with emphasis on titanium and composite structures. The operation of the Concorde is examined as a baseline for projections into the future. A market survey of U.S. passenger attitudes and preferences, the impact of advanced air transport technology and the integration of systems for the advanced SST and for a smaller research/business jet vehicle are also discussed. For individual titles, see N81-18006 through N81-18022.

N81-18006*# Lockheed-California Co., Burbank.
STRUCTURAL CONCEPT TRENDS FOR COMMERCIAL SUPERSONIC CRUISE AIRCRAFT DESIGN **c05**
I. F. Sakat, G. W. Davis, and B. Saelman *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 563-587 refs 2 Vol. (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

Structural concept trends for future commercial supersonic transport aircraft are considered. Highlights, including the more important design conditions and requirements, of two studies are discussed. Knowledge of these design parameters, as determined through studies involving the application of flexible mathematical models, enabled inclusion of aeroelastic considerations in the structural-material concepts evaluation. The design trends and weight data of the previous contractual study of Mach 2.7 cruise aircraft were used as the basis for incorporating advanced materials and manufacturing approaches to the airframe for reduced weight and cost. Structural studies of design concepts employing advanced aluminum alloys, advanced composites, and advanced titanium alloy and manufacturing techniques are compared for a Mach 2.0 arrow-wing configuration concept. Appraisals of the impact of these new materials and manufacturing concepts to the airframe design are shown and compared. The research and development to validate the potential sources of weight and cost reduction identified as necessary to attain a viable advanced commercial supersonic transport are discussed. A.R.H.

N81-18007*# Douglas Aircraft Co., Inc., Long Beach, Calif.
OPPORTUNITIES FOR STRUCTURAL IMPROVEMENTS FOR AN ADVANCED SUPERSONIC TRANSPORT VEHICLE **c05**
J. E. Fischler *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 589-616 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

The superplastically formed diffusion-bonded (SPF/DB) program has developed successfully and far enough to recommend that a major structural program to validate the weight and cost of SPF/DB sandwich titanium structure should be initiated. The NASA Langley study of wing and fuselage SPF/DB sandwich panels shows that this process is potentially structurally efficient. The Douglas SPF/DB expanded sandwich process that utilizes a welded core sheet that expands to face sheets proves to be very efficient. The theoretical weight optimization design charts for the wing and fuselage concepts were validated by small-scale tests. Mnay design applications were fabricated. Projecting the results of an SPF/DB sandwich airframe structure to a MDC AST design shows significant weight and cost savings. A 6 percent lower direct operating cost was calculated. A growth AST utilizing composites, metal matrices, and SPF/DB sandwich shows future promise for a post-1990 technology readiness. Titanium SPF/DB sandwich, compared to presently available aluminum structure, is superior for application to a Mach 2.2 supersonic transport. A.R.H.

N81-18008*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC CRUISE RESEARCH AIRCRAFT STRUCTURAL STUDIES: METHODS AND RESULTS **c05**
J. Sobieszczanski-Sobieski, David Gross (Kentron International, Hampton, Va.), William Kurtze, Jerry Newsom, Gregory Wrenn (Kentron International, Hampton, Va.), and William Greene (Kentron International, Hampton, Va.) *In its* Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 617-656 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

NASA Langley Research Center SCAR in-house structural studies are reviewed. In methods development, advances include a new system of integrated computer programs called ISSYS, progress in determining aerodynamic loads and aerodynamically induced structural loads (including those due to gusts), flutter optimization for composite and metal airframe configurations using refined and simplified mathematical models, and synthesis of active controls. Results given address several aspects of various SCR configurations. These results include flutter penalties on composite wing, flutter suppression using active controls, roll control effectiveness, wing tip ground clearance, tail size effect on flutter, engine weight and mass distribution influence on flutter, and strength and flutter optimization of new configurations. The ISSYS system of integrated programs performed well in all the applications illustrated by the results, the diversity of which attests to ISSYS' versatility. A.R.H.

N81-18009*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ASSESSMENT OF BUFFER STRIPS FOR IMPROVING DAMAGE TOLERANCE **c05**
C. C. Poe, Jr. and John M. Kennedy *In its* Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 657-673 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

Graphite/epoxy panels with buffer strips were tested in tension to measure their residual strength with crack-like damage. Panels were made with [45/0/-45/90](2S) and [45/0/450](2S) layups. The buffer strips were parallel to the loading directions. They were made by replacing narrow strips of the 0 deg graphite plies with strips of either 0 deg S-Glass/epoxy or Kevlar-49/epoxy on either a one for one or a two for one basis. In a third case, 0 deg graphite/epoxy was used as the buffer material and thin, perforated Mylar strips were placed between the 0 deg piles and the cross-plies to weaken the interfaces and thus to isolate the 0 deg plies. Some panels were made with buffer strips of different widths and spacings. The buffer strips arrested the cracks and increased the residual strengths significantly over those plain laminates without buffer strips. A shear-lag type stress analysis correctly predicted the effects of layups, buffer material, buffer strip width and spacing, and the number of plies of buffer material. Author

N81-18010*# Boeing Aerospace Co., Seattle, Wash.
EVALUATION OF HIGH-TEMPERATURE STRUCTURAL ADHESIVES FOR EXTENDED SERVICE **c27**
Carl L. Hendricks and Sylvester G. Hill *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2, Mar. 1980 p 675-686 (For primary document see N81-18005 09-01) (Contract NAS1-15605)
Avail: NTIS HC A18/MF A01 CSCL 11A

Candidate high-temperature stable resin formulations were evaluated for adhesive properties when bonded to titanium treated with various surface preparations. The adhesive formulations included LARC-13, NR150 A2, NR150 B2, NR056X, FM-34, HR-602, and polyphenylquinoxaline. Eight titanium surface preparations were compared for resulting bond strength with the candidate adhesives. After initial evaluation, three adhesive systems (comprised of adhesive, primer, and titanium surface preparation) were selected for further screening. The screening (still in progress) includes cure-cycle optimization and bond properties from 219 K (-65 F) to 505 K (450 F), after isothermal aging at 505 K (450 F) up to 15,000 hours, and after humidity aging at 322 K (9120 F)/ 95 percent R. H. for up to 2000 hours. Larger-area bond capability of the three adhesive system can be demonstrated by fabrication of 30.5 cm (12 in) square titanium honeycomb sandwich and metal-to-metal bonded panels. Author

N81-18011*# Lockheed-California Co., Burbank.
ADVANCED MATERIALS AND FABRICATION PROCESSES FOR SUPERSONIC CRUISE AIRCRAFT **c26**
Marlon K. Guess, Russell S. Kaneko, and George G. Wald *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 687-712 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 11F

Research and development programs to develop high-strength aluminum alloys and low-cost materials and fabrication techniques for titanium alloys are being conducted. Thirteen aluminum alloy compositions are being evaluated. A section of a production component was fabricated using superplastic forming and diffusion bonding (SPF/DB) and fabrication studies are being conducted on three low temperature forming beta titanium alloys. Cost studies indicate substantial structural cost reduction potentials resulting from the use of both aluminum alloys and low-cost titanium fabrication techniques. Lowest overall costs are indicated for a composite/aluminum or composite titanium structure. A.R.H.

N81-18012*# Douglas Aircraft Co., Inc., Long Beach, Calif.
EFFECTS OF AN AST PROGRAM ON US TITANIUM STORY **c26**
Richard D. Fitzsimmons *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 713-736 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 11F

The singular importance of titanium as the primary structural material for an efficient advanced supersonic transport (AST) is outlined. The advantages of titanium over other metals are shown to apply to future subsonic aircraft as well as for supersonic designs. The cost problem of titanium is addressed and shown to be markedly reduced by the emerging technologies of superplastic forming/diffusion bonding sandwich, hot isostatic pressing of titanium powders, and isothermal forgings if demonstration programs should validate preliminary findings. The impact of a U.S. AST program on the United States titanium supply and demand picture is postulated. Author

N81-18013*# British Aerospace Aircraft Group, Bristol (England).
CONCORDE WITH THE AIRLINES **c03**
Clive S. Leyman *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 741-757 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

The only supersonic aircraft in airline service, Concorde, offers the first actual test of supersonic cruise feasibility and the only real experience relative to passenger, airline, and community acceptance. The dominant characteristic of Concorde operations is low aircraft utilization, due partly to the restricted route network. Operating costs, the maintenance/reliability record and associated dispatch delays are discussed. Problems with overwater operations, and the secondary boom phenomena are examined. Monthly average load factors for various routes, major causes of technical delays, aircraft technical performance, and aircraft tracks are graphically depicted. A.R.H.

N81-18014*# Boeing Commercial Airplane Co., Seattle, Wash.
LONG-RANGE AIRPLANE STUDY: THE CONSUMER LOOKS AT SST TRAVEL **c03**
Karyl H. Landes and J. A. Matter (Boeing Computer Services, Inc., Seattle, Wash.) *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 759-804 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

The attitudes of long-range air travelers toward several basic air travel decisions, were surveyed. Of interest were tradeoffs involving time versus comfort and time versus cost as they pertain to supersonic versus conventional wide-body aircraft on overseas routes. The market focused upon was the segment of air travelers most likely to make that type of tradeoff decision: those having flown overseas routes for business or personal reasons in the recent past. The information generated is intended to provide quantifiable insight into consumer demand for supersonic as compared to wide-body aircraft alternatives for long-range overseas air travel. A.R.H.

N81-18015*# Office of Technology Assessment, Washington, D. C.
ASSESSMENT OF THE IMPACT OF ADVANCED AIR-TRANSPORT TECHNOLOGY **c03**
R. L. Maxwell and L. V. Dickinson, Jr. *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 805-819 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

The long term prospects for commercial supersonic transportation appear attractive enough to keep supersonic research active and reasonably healthy. On the other hand, the uncertainties surrounding an advanced supersonic transport, (AST) specifically fuel price, fuel availability and noise, are too significant to warrant an accelerated research and development program until they are better resolved. It is estimated that an AST could capture about $50 billion (1979 dollars) of the potential $150 billion in sales up to the year 2010. A.R.H.

N81-18016*# Boeing Commercial Airplane Co., Seattle, Wash.
OVERVIEW OF BOEING SUPERSONIC TRANSPORT EFFORTS, 1971 - 1979 **c05**
A. Sigalla *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 821-832 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

Following cancellation of the United States Supersonic Transport program, the status of the technology was assessed carefully and emphasis was put on finding solutions for what were considered the major technical difficulties. In particular, work on the breakthroughs needed to advance the technology was emphasized. Currently, solutions to all major technical problems are identified. Depending on the subject, either the problem is no longer a concern or the steps needed to bring about a solution are mapped out clearly. Throughout the NASA SCR program, important strides were made in the identification of design advances which would greatly improve supersonic airplane fuel efficiency, noise, and other performance and cost affecting parameters. Furthermore, these efforts created an atmosphere in which it was possible for new ideas to flourish and positive inventions to take place such as the variable cycle engine and the blended fuselage. These technical gains show that, given availability of such technology, advanced supersonic transports could be developed that would be economically successful and environmentally acceptable. A.R.H.

N81-18017*# Boeing Commercial Airplane Co., Seattle, Wash.
A FAMILY OF SUPERSONIC AIRPLANES: TECHNICAL AND ECONOMIC FEASIBILITY **c05**
Frank D. Neumann and Jerry W. Whitten *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 833-854 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

To improve the prospects for success in the market place, the family approach is essential to the design of future supersonic airplanes. The evolution from a basic supersonic airplane to a family could follow historic patterns, with one exception: substantial changes in passenger carrying capacity will be difficult by the conventional fuselage 'doughnut' approach so successfully used on the cylindrical fuselage of subsonic airplanes. The primary reasons for this difference include the requirement for highly integrated 'area ruled' configurations, to give the desired high supersonic aerodynamic efficiency, and other physical limitations such as takeoff and landing rotation. A concept for a supersonic airplane family that could effectively solve the variable range and passenger capacity problem provides for modification of the fuselage cross section that makes it possible to build a family of three airplanes with four, five, and six abreast passenger seating. This is done by replacing or modifying portions of the fuselage. All airplanes share the same wing, engines, and major subsystems. Only small sections of the fuselage would be different, and aerodynamic efficiency need not be compromised. A.R.H.

N81-18018*# Boeing Commercial Airplane Co., Seattle, Wash.
IMPACT OF CHANGING FUEL CHARACTERISTICS ON SUPERSONIC CRUISE AIRPLANE **c28**
O. J. Hadaller, J. E. Schmidt, A. M. Momenthy, and P. E. Johnson *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 855-872 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 21D

The question of an advanced supersonic cruise research airplane is related to future oil supplies and prices. Technical data on the impact of changing fuel characteristics on the SCR airplane were developed. Projections of crude oil characteristics typical of the 1985 to 2000 time period were made with the help of consultants to the oil industry. Refineries for the future were modeled to establish jet fuel of engine and aircraft systems for future airplanes, with emphasis on supersonic cruise airplanes. Study results do not show a need for broadening the fuel specification. Hypothetical study fuels with broader specifications were defined, however, as was the impact of their properties on the SCR airplane and systems. A.R.H.

N81-18019*# McDonnell-Douglas Corp., Long Beach, Calif.
TECHNOLOGY DEVELOPMENT STATUS AT McDONNELL DOUGLAS **c05**
William T. Rowe *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 873-888 (For primary

document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

The significant technology items of the Concorde and the conceptual MCD baseline advanced supersonic transport are compared. The four major improvements are in the areas of range performance, structures (materials), aerodynamics, and in community noise. Presentation charts show aerodynamic efficiency; the reoptimized wing; low scale lift/drag ratio; control systems; structural modeling and analysis; weight and cost comparisons for superplasticity diffusion bonded titanium sandwich structures and for aluminum brazed titanium honeycomb structures; operating cost reduction; suppressor nozzles; noise reduction and range; the bicone inlet; a market summary; environmental issues; high priority items; the titanium wing and fuselage test components; and technology validation. A.R.H.

N81-18020*# McDonnell-Douglas Corp., Long Beach, Calif.
SUPERSONIC MARKET AND ECONOMIC ANALYSES c03
Lucian S. Rochte *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 889-907 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

Advanced supersonic transport markets of the free world were projected for the period 1985 to 2004. Passenger traffic volume and airplane range and seat capacity requirements were estimated for Mach 2.2 service by international regional area market areas and by city pairs within and between these areas. Market factors and traffic factors examined include variable loads, growth rates, supersonic transport market shares, and schedule frequencies considering the different makeup of passenger traffic and individual city pairs. Direct, indirect, and total operating costs and yield levels were economically analyzed for first class and full fare economy class traffic. A.R.H.

N81-18021*# Lockheed-California Co., Burbank.
THE IMPACT OF MATERIALS TECHNOLOGY AND OPERATIONAL CONSTRAINTS ON THE ECONOMICS OF CRUISE SPEED SELECTION c03
J. S. Clauss, Jr., F. A. Bruckman, D. L. Horning, R. H. Johnston, and J. V. Werner *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 909-934 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

Six material concepts at Mach 2.0 and three material concepts at Mach 2.55 were proposed. The resulting evaluations, based on projected development, production, and operating costs, indicate that aircraft designs with advanced composites as the primary material ingredient have the lowest fare premiums at both Mach 2.0 and 2.55. Designs having advanced metallics as the primary material ingredient are not economical. Advanced titanium, employing advanced manufacturing methods such as SFF/DB, requires a fare premium of about 30 percent at both Mach 2.0 and 2.55. Advanced aluminum, usable only at the lower Mach number, requires a fare premium of 20 percent. Cruise speeds in the Mach 2.0-2.3 regime are preferred because of the better economics and because of the availability of two material concepts to reduce program risk - advanced composites and advanced aluminums. This cruise speed regime also avoids the increase in risk associated with the more complex inlets and airframe systems and higher temperature composite matrices required at the higher Mach numbers typified by Mach 2.55. A.R.H.

N81-18022*# Rockwell International Corp., Los Angeles, Calif. North American Aircraft Div.
SUPERSONIC CRUISE VEHICLE RESEARCH/BUSINESS JET c05
Robert J. Kelly *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 935-949 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

A comparison study of a GE-21 variable propulsion system with a Multimode Integrated Propulsion System (MMIPS) was conducted while installed in small M = 2.7 supersonic cruise vehicles with military and business jet possibilities. The 1984 state of the art vehicles were sized to the same transatlantic range, takeoff distance, and sideline noise. The results indicate the MMIPS would result in a heavier vehicle with better subsonic cruise performance. The MMIPS arrangement with one fan engine and two satellite turbojet engines would not be appropriate for a small supersonic business jet because of design integration penalties and lack of redundancy. Author

N81-18023*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CIVIL MARKETS FOR BUOYANT HEAVY-LIFT VEHICLES
Peter J. Mettam (Booz, Allen and Hamilton, Bethesda, Md.), Dagfin Hansen (Booz, Allen and Hamilton, Bethesda, Md.), and Mark D. Ardema Mar. 1981 36 p refs
(NASA-TM-81270) Avail: NTIS HC A03/MF A01 CSCL 01B

Worldwide civil markets for heavy lift airships were investigated. Substantial potential market demand was identified for payloads of from 13 to 800 tons. The largest markets appear to be in applications to relieve port congestion, construction of power generating plants, and, most notably, logging. Because of significant uncertainties both in vehicle and market characteristics, further analysis will be necessary to verify the identified market potential of heavy lift airship concepts. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-18024 Mississippi State Univ., State College.
AN APPROXIMATE FACTORIZATION SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR TRANSONIC FLOW USING BODY-FITTED COORDINATES WITH APPLICATION TO NACA 64A010 AIRFOILS Ph.D. Thesis
George Kyle Cooper 1980 124 p
Avail: Univ. Microfilms Order No. 8104478

Although aircraft were routinely flown at transonic speeds for the last two decades, the designers of these machines have had to formulate their designs almost exclusively on the basis of experience, in contrast to subsonic or supersonic aircraft design in which a welter or analytical, experimental, and numerical techniques exist. Since this type of fluid flow is characterized by complex viscid-inviscid interactions, the development of fast numerical models of the full Navier-Stokes equations promises to alleviate this situation. One such model is the approximate factorization algorithm introduced by Beam and Warming and implemented by Steger, et al. This research is principally concerned with an independent implementation of this numerical algorithm and initial studies of its ability to efficiently and accurately describe transonic flow about an NACA 64A010 airfoil section. The approximate factorization algorithm is developed from the nondimensional, conservative, vectorized Navier-Stokes equations expressed in curvilinear coordinates. Dissert. Abstr.

N81-18025 Stanford Univ., Calif.
OPTIMAL CONTROL OF MULTIRATE DIGITAL CONTROL SYSTEMS Ph.D. Thesis
Naftali Amit 1980 182 p
Avail: Univ. Microfilms Order No. 8103478

Aerospace systems are characterized by high order models with numerous controls and measurements. In order to efficiently utilize the computer as a digital compensator, several sampling rates are allocated to different modes of the plant. The multirate system is a particular case of the more general periodically time varying multiple order system. A computer algorithm, MUTSIR, was coded in FORTRAN to solve the optimum gains of multirate regulators and steady state estimators. The average response to noise is computed for either full knowledge of the states or the fully compensated system. This numerical tool is applied to the regulation problem of a fourth order oscillating plant. The effects of control bandwidth coupling, dispersion of open loop mode frequencies and sampling rate ratio are investigated. The performance of two approximate approaches, having constant gains, are compared with the performance of the exact time varying solution, over a wide range of parameter variations. Based

on these comparisons, a design procedure is outlined.
Dissert. Abstr.

N81-18026 Rochester Univ., N. Y.
HYDRODYNAMIC STABILITY OF A COMPRESSIBLE SUPERSONIC SHEARING MIXING LAYER Ph.D. Thesis
Ahmed Abdel-Aziz Metwalli 1981 103 p
Avail: Univ. Microfilms Order No. 8104315

The stability analysis was posed as an eigenvalue problem in which the linearized hydrodynamic equations for small three dimensional disturbances have characteristic spatial growth or damping rates. Numerical solutions were constructed at the asymptotic edges of the boundary layer. The lower solution was then integrated across the boundary layer where it is matched at the upper edge. The Newton-Raphson method was used to find eigenvalues which identically satisfy the matching condition. The results show that with increasing Mach number of the reference upper stream M sub 1, with the lower stream held stationary, more than s single stability mode is present. Up to three modes were obtained at M sub 1 = 3.0. The results are interpreted with respect to the spreading of the turbulent shearing layer. It is found that increasing the Mach number of the flow M sub 1 tends to stabilize the flow. Dissert. Abstr.

N81-18027*# Flow Research, Inc., Kent, Wash.
AERODYNAMIC EFFECTS OF NEARLY UNIFORM SLIPSTREAMS ON THIN WINGS IN THE TRANSONIC REGIME Final Report
Magdi H. Rizk May 1980 58 p refs
(Contract NAS2-9913)
(NASA-CR-152351) Avail: NTIS HC A04/MF A01 CSCL 01A

A simplified model is used to describe the interaction between a propeller slipstream and a wing in the transonic regime. The undisturbed slipstream boundary is assumed to coincide with an infinite circular cylinder. The undisturbed slipstream velocity is rotational and is a function of the radius only. In general, the velocity perturbation caused by introducing a wing into the slipstream is also rotational. By making small disturbance assumptions, however, the perturbation velocity becomes nearly potential, and an approximation for the flow is obtained by solving a potential equation. A.R.H.

N81-18028*# Kaman Aerospace Corp., Bloomfield, Conn.
MULTICYCLIC CONTROLLABLE TWIST ROTOR DATA ANALYSIS Final Report
Fu-Shang Wei and A. L. Weisbrich 15 Jan. 1979 170 p refs
(Contract NAS2-8726)
(NASA-CR-152251; R-1562) Avail: NTIS HC A08/MF A01 CSCL 01A

Rsults provide functional relationship between rotor performance, blade vibratory loads and dual control settings and indicate that multicyclic control produced significant reductions in blade flatwise bending moments and blade root actuator control loads. Higher harmonic terms of servo flap deflection were found to be most pronounced in flatwise bending moment, transmission vertical vibration and pitch link vibratory load equations. The existing test hardware represents a satisfactory configuration for demonstrating MCTR technology and defining a data base for additional wind tunnel testing. T.M.

N81-18029*# Arizona Univ., Tucson. College of Engineering.
TRANSONIC FLOW STUDIES Final Report, 1 Nov. 1975 - 31 Oct. 1980
Richard A. Seebass and K.-Y. Fung 28 Feb. 1981 230 p refs
(Grant NsG-2112)
(NASA-CR-163965; TFD-81-01) Avail: NTIS HC A10/MF A01 CSCL 01A

Major emphasis was on the design of shock free airfoils with applications to general aviation. Unsteady flow, transonic flow, and shock wave formation were examined. T.M.

N81-18030*# National Aeronautics and Space Administration, Washington, D. C.
DEVELOPMENT AND WIND TUNNEL INVESTIGATION OF THREE SUPERCRITICAL AIRFOIL PROFILES FOR TRANSPORT AIRCRAFT
E. Stanewsky and H. Zimmer Nov. 1980 50 p refs Transl. into ENGLISH of 'Entwicklung und windkanalerprobung von drei ueberkritischen traffluegelprofilen fuer verkehrsflugzeuge" Rept. DGLR Paper 74-100 West Germany, 1974 54 p Presented at the 7th Jahrestagung, Kiel, 17-19 Sep. 1974; sponsored by DGLR Original language document was announced as A75-24147 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Dornier G.m.b.H., Friedrichshafen, West Germany
(Contract NASw-3198)
(NASA-TM-75840) Avail: NTIS HC A03/MF A01 CSCL 01A

Three supercritical airfoil profiles were designed for transport aircraft and were tested in a wind tunnel. The investigation of the profiles CAST 7 and CAST 10-2 for different Reynolds numbers and free and forced transition show that the flow development over these profiles in the important incident flow regions depends very greatly on the Reynolds number and the position of the transition strip. This strong dependence results from the large pressure gradients in the vicinity of the profile trailing edge and the related danger of trailing edge separation, as well as the low pressure or Mach number gradient of the compression shock on the suction side of the profile. The strong dependence of the development of the trailing edge separation with increasing Mach number or increasing angle of attack on the initial boundary layer thickness, that is the boundary layer ahead of the compression shock, is the decisive factor here. The tests of the airfoil profiles were carried out for free transition and a Reynolds number Re = 2,400,000. E.D.K.

N81-18031*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
MEAN VELOCITIES AND REYNOLDS STRESSES IN A JUNCTURE FLOW Status Report, 31 Mar. - 31 Dec. 1980
H. McMahon, J. E. Hubbartt, and L. Kubendran Feb. 1981 74 p refs
(Contract NAG1-40)
(NASA-CR-164029) Avail: NTIS HC A04/MF A01 CSCL 01A

The juncture flow was generated by a constant thickness body, having an elliptical leading edge, which was mounted perpendicular to a large flat plate along which a turbulent boundary layer was developing. At each measurement station within the viscous juncture region, the direction of the local mean velocity vector was determined. Then, in a local plane which is normal to the flat plate and tangential to the local mean velocity vector, the horizontal and vertical mean velocity components, together with two normal turbulent stresses and one tangential turbulent stress, were measured using a hot wire anemometer. The secondary flow in the juncture causes significant changes in the profiles of mean local velocity. The turbulence stress profiles are altered considerably when compared with those in a two dimensional boundary layer. T.M.

N81-17983*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RESULTS OF A LOW-SPEED WIND TUNNEL TEST OF THE MDC 2.2M SUPERSONIC CRUISE AIRCRAFT CONFIGURATION
L. P. Yip, L. P. Parlett, R. L. Roensch, J. E. Felix, and H. R. Welge *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 35-57 refs Prepared in cooperation with Douglas Aircraft Co., Long Beach, Calif. (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

N81-17984*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE PREDICTION OF PRESSURE DISTRIBUTIONS ON AN ARROW-WING CONFIGURATION INCLUDING THE EFFECT OF CAMBER, TWIST, AND A WING FIN
Percy J. Bobbitt, Marjorie E. Manro, and Robert M. Kulfan *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 59-115 refs Prepared in cooperation with the Boeing Commercial Airplane Co., Seattle (For primary document see N81-17981 09-01)
(Contracts NAS1-12875; NAS1-4141; NAS1-14962;

NAS1-15678)
Avail: NTIS HC A23/MF A01 CSCL 01A

N81-17985*# Old Dominion Univ., Norfolk, Va.
EXPLORATORY SUBSONIC INVESTIGATION OF VORTEX-FLAP CONCEPT ON ARROW WING CONFIGURATION
Dhanvada M. Rao *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1981 p 117-129 refs (For primary document see N81-17981 09-01)
(Contract NsG-1315)
Avail: NTIS HC A23/MF A01 CSCL 01A

N81-17986*# Boeing Commercial Airplane Co., Seattle, Wash.
WIND TUNNEL TEST RESULTS OF A NEW LEADING EDGE FLAP DESIGN FOR HIGHLY SWEPT WINGS, A VORTEX FLAP
L. James Runyan, Wilbur D. Middleton, and John A. Paulson *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 131-147 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

N81-17988*# Boeing Commercial Airplane Co., Seattle, Wash.
PREDICTION OF NACELLE AERODYNAMIC INTERFERENCE EFFECTS AT LOW SUPERSONIC MACH NUMBERS
Robert M. Kulfan *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 171-203 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

N81-18246# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STRUCTURES OF FLOW SEPARATIONS OVER SWEPT WINGS
Henry Werle *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 9-33 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 85-108 Original report in FRENCH previously announced as A80-46227 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

N81-18257# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL STUDY OF THE SEPARATION AT THE TRAILING EDGE OF AN AXISYMMETRICAL CONTOURED AFTER-BODY
Jean-Louis Solignac *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 65-71 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 205-211 Original report in FRENCH previously announced as A80-43549 (For primary document see N81-18251 09-31)
Avail: NTIS HC A05/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N81-18032*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
A SCHEDULING MODEL FOR THE AERIAL RELAY SYSTEM
Raymond A. Ausrotas and Elliott W. Liu Sep. 1980 113 p refs
(Contract NAS1-15268)
(NASA-CR-159387; FTL-R79-10) Avail: NTIS HC A06/MF A01 CSCL 01C

The ability of the Aerial Relay System to handle the U.S. transcontinental large hub passenger flow was analyzed with a flexible, interactive computer model. The model incorporated city pair time of day demand and a demand allocation function which assigned passengers to their preferred flights. T.M.

N81-18033*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THEORETICAL STUDY OF NETWORK DESIGN METHODOLOGIES FOR THE AERIAL RELAY SYSTEM
Jorge M. Rivera and Robert W. Simpson Jun. 1980 182 p refs
(Contract NAS1-15268)
(NASA-CR-159365; FTL-R80-10) Avail: NTIS HC A09/MF A01 CSCL 01C

The aerial relay system network design problem is discussed. A generalized branch and bound based algorithm is developed which can consider a variety of optimization criteria, such as minimum passenger travel time and minimum liner and feeder operating costs. The algorithm, although efficient, is basically useful for small size networks, due to its nature of exponentially increasing computation time with the number of variables.
Author

N81-18034# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EVALUATION OF AFIT/F-16 RESTRAINT CONCEPTS IN THE + OR - 2Gy ENVIRONMENT
Robert E. VanPatten, John W. Frazier, Daniel W. Repperger, and Dana B. Rodgers Oct. 1980 24 p
(AF Proj. 7231)
(AD-A094323; AFAMRL-TR-80-130) Avail: NTIS HC A02/MF A01 CSCL 05/5

The acceleration stresses imposed by the lateral (+ or - Gy) maneuvering capabilities of six-degrees-of-freedom (6 DOF) aircraft, such as the AFTI/F-16, may potentially impact pilot performance. This centrifuge research was done to evaluate the effectiveness of special canopy-rail-mounted shoulder restraints at + or - Gy in the presence of a sum-of-sines tracking task implemented via a side stick (force) controller. Results indicate that additional restraints are desirable. GRA

N81-17994*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF SCR AIRCRAFT TAKEOFF AND LANDING PROCEDURES FOR COMMUNITY NOISE ABATEMENT AND THEIR IMPACT ON FLIGHT SAFETY
William D. Grantham and Paul M. Smith (Kentron International, Inc.) *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 299-333 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N81-18013*# British Aerospace Aircraft Group, Bristol (England).
CONCORDE WITH THE AIRLINES
Clive S. Leyman *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 741-757 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18014*# Boeing Commercial Airplane Co., Seattle, Wash.
LONG-RANGE AIRPLANE STUDY: THE CONSUMER LOOKS AT SST TRAVEL
Karyl H. Landes and J. A. Matter (Boeing Computer Services, Inc., Seattle, Wash.) *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 759-804 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18015*# Office of Technology Assessment, Washington, D. C.
ASSESSMENT OF THE IMPACT OF ADVANCED AIR-TRANSPORT TECHNOLOGY
R. L. Maxwell and L. V. Dickinson, Jr. *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 805-819 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18020*# McDonnell-Douglas Corp., Long Beach, Calif.
SUPERSONIC MARKET AND ECONOMIC ANALYSES
Lucian S. Rochte *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 889-907 (For primary

document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18021*# Lockheed-California Co., Burbank.
THE IMPACT OF MATERIALS TECHNOLOGY AND OPERATIONAL CONSTRAINTS ON THE ECONOMICS OF CRUISE SPEED SELECTION
J. S. Clauss, Jr., F. A. Bruckman, D. L. Horning, R. H. Johnston, and J. V. Werner *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 909-934 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N81-18035*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
FAILURE DETECTION AND ISOLATION ANALYSIS OF A REDUNDANT STRAPDOWN INERTIAL MEASUREMENT UNIT Final Report, Oct. 1979 - Dec. 1980
P. Motyka, M. Landey, and R. McKern Feb. 1981 91 p refs (Contract NAS1-15933)
(NASA-CR-165658; R-1414) Avail: NTIS HC A05/MF A01 CSCL 17G

The objective of this study was to define and develop techniques for failure detection and isolation (FDI) algorithms for a dual fail/operational redundant strapdown inertial navigation system are defined and developed. The FDI techniques chosen include provisions for hard and soft failure detection in the context of flight control and navigation. Analyses were done to determine error detection and switching levels for the inertial navigation system, which is intended for a conventional takeoff or landing (CTOL) operating environment. In addition, investigations of false alarms and missed alarms were included for the FDI techniques developed, along with the analyses of filters to be used in conjunction with FDI processing. Two specific FDI algorithms were compared: the generalized likelihood test and the edge vector test. A deterministic digital computer simulation was used to compare and evaluate the algorithms and FDI systems. E.D.K.

N81-18036# Champlain Technology Industries, Palo Alto, Calif.
EVALUATION OF THE PERFORMANCE OF THE REMOTE AREA PRECISION POSITIONING SYSTEM (RAPPS) Final Report, Feb. - Oct. 1980
E. H. Bolz and T. E. Scalise Oct. 1980 74 p refs
(Contract DOT-FA75WA-3662)
(AD-A094169; FAA-RD-80-120) Avail: NTIS HC A04/MF A01 CSCL 17/7

A flight test program was flown within the coverage area of the West Coast Loran-C chain during June and July 1979. These tests were conducted for Loran-C evaluation purposes. The Remote Area Precision Positioning System (RAPPS) was utilized as the data collector and independent positioning system for those tests. This report presents an evaluation of the performance of the RAPPS system under actual test conditions. The RAPPS positioning system is based on DME multilateration and takes advantage of existing TACAN or DME installations. It was found under certain conditions to suffer degradation due to multipath propagation and signal dropouts due to terrain masking. After isolating clearly erroneous measurements, residual ranging errors of 285 ft (1 sigma) were estimated based on available data. The RAPPS data collector was designed to acquire data from two Loran-C receivers, the DME subsystem, an altimeter and a clock. The data collector functioned satisfactorily with a few deficiencies. The foremost deficiency was a lack of precise time-tagging of each individual data element, which caused processing of the Loran-C data to be quite difficult. GRA

N81-18037# Federal Aviation Agency, Atlantic City, N.J. Technical Center.
DISCRETE ADDRESS BEACON SYSTEM (DABS) RECEIVER AND AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS) AND DABS PROCESSOR SUBSYSTEM TESTS Final Report, Feb. - Dec. 1979
Leonard H. Baker Dec. 1980 59 p refs
(AD-A094124; FAA-CT-80-11; FAA-RD-80-75) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report describes the subsystem interrogator and processor tests conducted by the Federal Aviation Administration (FAA) Technical Center on the engineering laboratory model of the Discrete Address Beacon System (DABS). These tests were conducted to determine the performance of the multichannel receiver and the Air Traffic Control Radar Beacon System (ATCRBS) and DABS processors. These performance test results supplement the functional subsystem testing performed by Texas Instruments, Incorporated during the factory tests. The results of the receiver tests were used to determine the operating parameters and performance of the monopulse receiver and the operating characteristics of the video quantizer. The ATCRBS reply processor tests identified the static performance and characteristics of the variable parameters in this unit. The DABS reply processor tests defined the performance of the critical elements in the DABS processor. These elements were the video digitizer, the message bit and monopulse processing, and the error detection and correction. Identification and optimization of the characteristics of the variable parameters of this unit were determined. It was concluded that the subsystems tested met the requirements specified in the DABS engineering requirement (ER) FAA-ER-240-26. GRA

N81-18038# Mitre Corp., McLean, Va. Metrek Div.
CONFLICT MONITORING ANALYSIS OF PARALLEL ROUTE SPACING IN THE HIGH ALTITUDE AIRSPACE, VOLUME 2 Interim Report
Arthur P. Smith, III Jul. 1980 121 p refs
(Contract DOT-FA80WA-4370)
(AD-A094152; MTR-79W00235-Vol-2; FAA-EM-80-16-Vol-2)
Avail: NTIS HC A06/MF A01

The work reported in this document was undertaken as part of the examination of the soundness of the current standards for the spacing between parallel aircraft routes and the enhancement of analytical methods to evaluate future standards. This interim report describes work completed to date on the Conflict Monitoring Parallel Route Spacing Analysis. This analysis assesses the potential for collision and the controller workload associated with aircraft flying on same direction parallel routes. To assess the potential for collision the analysis considers a conflict alert function similar to that employed in the National Airspace System. The conflict alert function detects pairs of aircraft which are projected to violate the radar separation standard within a given time period. In the analysis, the event of a conflict alert is followed by a probabilistic delay and a resolution maneuver characterized by a randomly chosen horizontal turn rate. The controller intervention rate is estimated by using a simulation. Actual aircraft tracks were sampled from the FAA data base which supports this activity. GRA

N81-18039# Mitre Corp., McLean, Va.
AUTOMATIC TRAFFIC ADVISORY AND RESOLUTION SERVICE (ATARS) MULTI-SITE, ALGORITHMS, REVISION 1
R. H. Lentz, W. D. Love, N. S. Malthouse, D. L. Roberts, T. L. Signore, R. A. Tornese, and A. D. Zeitlin Oct. 1980 503 p refs
(Contract DOT-FA80WA-4370)
(AD-A094195; MTR-80W00100-Rev-1; FAA-RD-80-3-Rev-1)
Avail: NTIS HC A22/MF A01 CSCL 01/5

This document presents detailed computer algorithms for programming the Automatic Traffic Advisory and Resolution Service (ATARS), formerly known as IPC, within a multi-site Discrete Address Beacon System (DABS) network. This document is to be used by Federal Aviation Administration to specify and define the ATARS portion of the integrated DABS/ATARS system. The FAA has directed that the Conflict Indicator Register (CIR) be replaced by the Resolution Advisory Register (RAR) as the avionics mechanism for coordinating resolution advisories

between ATARS sites and between ATARS and BCAS. Since it will be some time before the RAR can be fully incorporated into the ATARS algorithms, a number of modifications have been made to the ATARS logic which will permit testing of the rest of the ATARS design, while eliminating the special CIR message requirements, now obsolete, upon the DABS sensor. These modifications constitute Revision 1 to the original MITRE technical report on the ATARS multi-site algorithms. GRA

N81-18040# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ACTIVE BEACON COLLISION AVOIDANCE SYSTEM (BCAS) FUNCTIONAL OVERVIEW
J. D. Welch and V. A. Orlando 17 Dec. 1980 44 p refs
(Contract DOT-FA72WAI-817)
(AD-A094177; ATC-102; FAA-RD-80-127) Avail: NTIS HC A03/MF A01 CSCL 17/9

The Active Beacon Collision Avoidance System (BCAS) is a beacon-based airborne collision avoidance system that provides for cooperative threat resolution between BCAS and conflicting aircraft and coordination with the ground ATC control function through the DABS data link. All beacon-equipped aircraft in the vicinity of the BCAS are detected. ATCRBS-equipped aircraft are interrogated using a special Mode C interrogation, DABS aircraft are initially detected passively. Those aircraft that represent a possible threat are discretely interrogated to maintain a range/altitude track. This document provides a functional overview of BCAS including operational features, a description of the avionics package, and examples of surveillance data obtained with experimental BCAS equipment. The results show that reliable surveillance performance is achieved in low and medium density airspace. GRA

N81-18041# Mitre Corp., McLean, Va. Metrek Div.
CONFLICT MONITORING ANALYSIS OF PARALLEL ROUTE SPACING IN THE HIGH ALTITUDE CONUS AIRSPACE, VOLUME 1 Interim Report
Arthur P. Smith, III Jul. 1980 65 p refs
(Contract DOT-FA80WA-4370)
(AD-A094071; MTR-79W00235-Vol-1; FAA-EM-80-16-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 01/2

This work was undertaken as part of the examination of the soundness of the current standards for the spacing between parallel aircraft routes and the enhancement of analytical methods to evaluate future standards. This report describes work completed to date on the Conflict Monitoring Parallel Route Spacing Analysis. This analysis assesses the potential for collision and the controller workload associated with aircraft flying on same direction parallel routes. To assess the potential for collision the analysis considers a conflict alert function similar to that employed in the National Airspace System. The conflict alert function detects pairs of aircraft which are projected to violate the radar separation standard within a given time period. In the analysis the event of a conflict alert is followed by a probabilistic delay and a resolution maneuver characterized by a randomly chosen horizontal turn rate. The controller intervention rate is estimated by using a simulation. Actual aircraft tracks were sampled from the FAA data base which supports this activity. These tracks are initiated on the routes based on randomly chosen sector entry times which reflect the level of route loading. For both the potential for collision and the intervention rate, trial results based on a subset of the FAA data are given. GRA

N81-18042# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
DEFINITION OF THE PROBLEMS ASSOCIATED WITH AIR TRAFFIC CONTROL OF CLOSELY SPACED HELICOPTER TRAFFIC PERFORMING DECELERATED INSTRUMENT APPROACHES Final Technical Report, 17 Sep. 1979 - 30 Jun. 1980
R. W. Simpson Ft. Monmouth, N. J. AVRADCOM Dec. 1980 66 p refs
(Contract DAAK80-79-C-0282; DA Proj. 1L2-26220-AH-85)
(AD-A094073; USAAVRADCOM-TR-79-0282-F) Avail: NTIS HC A04/MF A01 CSCL 17/7

This study reviews the requirements for a modern, high performance all weather Air Traffic Management and Control (ATM/C) System designed for U.S. Army airfields. A strawman ATM/C system is created to illustrate problems, and to identify research and development needs in surveillance, communications, and computer display and automation. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N81-18043 California Univ., Los Angeles.
APPLICATION OF THE FINITE ELEMENT METHOD TO ROTARY WING AEROELASTICITY Ph.D. Thesis
Friedrich Karl Straub 1980 237 p
Avail: Univ. Microfilms Order No. 8104040

A finite element method for the spatial discretization of the dynamic equations of equilibrium governing rotary wing aeroelastic problems is presented. The equations of motion are nonself adjoint, nonlinear, and in partial differential form. For this class of problems, variational principles are not available. Thus, formulation of the finite element equations is based on weighted Galerkin residuals. This Galerkin finite element method reduces algebraic manipulative labor significantly, when compared to the application of the global Galerkin method to similar problems. However, more computer time is spent on the numerical calculations. The numerical simulations of the flap lag problem show the Galerkin finite element method to be a practical tool. The results indicate that the trimmed flap lag problem is basically stable. Nonlinear effects and higher harmonic contributions are important for both stability and response, in particular, at high advance ratios and more so for flap than for lag. Inclusion of two modes for each elastic degree of freedom is necessary to reliably determine the blade response. Dissert. Abstr.

N81-18044*# Neilsen Engineering and Research, Inc., Mountain View, Calif.
CONTINUED DEVELOPMENT AND CORRELATION OF ANALYTICALLY BASED WEIGHT ESTIMATION CODES FOR WINGS AND FUSELAGES Contractor Technical Report, Jun. 1975 - May 1976
Joseph Mullen, Jr. Mar. 1978 139 p refs
(Contract NAS2-8558)
(NASA-CR-152331; NEAR-TR-161) Avail: NTIS HC A07/MF A01 CSCL 01C

The implementation of the changes to the program for Wing Aeroelastic Design and the development of a program to estimate aircraft fuselage weights are described. The equations to implement the modified planform description, the stiffened panel skin representation, the trim loads calculation, and the flutter constraint approximation are presented. A comparison of the wing model with the actual F-5A weight material distributions and loads is given. The equations and program techniques used for the estimation of aircraft fuselage weights are described. These equations were incorporated as a computer code. The weight predictions of this program are compared with data from the C-141. T.M.

N81-18045*# Neilsen Engineering and Research, Inc., Mountain View, Calif.
DATA BASE FOR THE PREDICTION OF AIRFRAME/PROPULSION SYSTEM INTERFERENCE EFFECTS Final Report, 14 Feb. 1977 - 1 Jan. 1979
Oden J. McMillan, Edward W. Perkins, Gary D. Kuhn, and Stanley C. Perkins, Jr. Nov. 1979 435 p refs
(Contract NAS2-9513)
(NASA-CR-152316; NEAR-TR-187) Avail: NTIS HC A19/MF A01 CSCL 01C

Supersonic tactical aircraft with highly integrated jet propulsion systems were investigated. Primary attention was given to those interference effects which impact the external aerodynamics of the aircraft. R.C.T.

N81-18046*# Mississippi State Univ., Mississippi State. Dept. of Aerospace Engineering.
AN APPLICATION OF WAKE SURVEY RAKES TO THE

EXPERIMENTAL DETERMINATION OF THRUST FOR A PROPELLER DRIVEN AIRCRAFT Final Report
K. R. Hall, S. J. Miley, and H. J. Tsai Feb. 1981 77 p refs
(Grant NsG-1454)
(NASA-CR-163967; MSSU-EIRS-ASE-81-3) Avail: NTIS HC A04/MF A01 CSCL 01C

The use of wake survey rakes for the in flight determination of the resultant thrust for a constant pitch propeller driven, low wing, single engine general aviation aircraft was investigated. The lack of slipstream static pressure distribution seriously affected the results but recommendations for removing the deficiency are discussed. The wake survey rake is shown to be a valuable tool in aircraft flight testing. E.D.K.

N81-18047*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
DESCRIPTION OF THE HiMAT TAILORED COMPOSITE STRUCTURE AND LABORATORY MEASURED VEHICLE SHAPE UNDER LOAD
Richard C. Monaghan Feb. 1981 60 p refs
(NASA-TM-81354; H-1144) Avail: NTIS HC A04/MF A01 CSCL 01C

The aeroelastically tailored outer wing and canard of the highly maneuverable aircraft technology (HiMAT) vehicle are closely examined and a general description of the overall structure of the vehicle is provided. Test data in the form of laboratory measured twist under load and predicted twist from the HiMAT NASTRAN structural design program are compared. The results of this comparison indicate that the measured twist is generally less than the NASTRAN predicted twist. These discrepancies in twist predictions are attributed, at least in part, to the inability of current analytical composite materials programs to provide sufficiently accurate properties of matrix dominated laminates for input into structural programs such as NASTRAN. A.R.H.

N81-18048# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
STRUCTURE AND LIFETIME ATTESTATION OF TORNADO [STRUKTUR UND LEBENSDAUERNACHWEIS FUER TORNADO]
Arendts Seibert 17 Dec. 1979 35 p In GERMAN Presented at DGLR Symp. on the MRCA program TORNADO, 13 Dec. 1979
(MBB-PUB-P-0001) Avail: NTIS HC A03/MF A01

Structural design and durability of the Tornado, a multirole combat aircraft, are discussed. The Tornado is a flexible wing, small combat airplane which is capable of low flight and short takeoff and landing. The construction expenses are relatively low for a small plane. The Tornado is very small airplane with considerable equipment packing density. It is concluded that though the number of flying hours is shorter, the amount of loads per flying hours, stress, and the hardness of fatigue spectra is considerably greater than those of transportation air carriers. Transl. by E.A.K.

N81-18049# Fiber Science, Inc., Salt Lake City, Utah.
HELICOPTER EXTERNAL CARGO SLING APEX FITTING: *DEVELOPMENT AND TESTING* Final Report, Apr. 1977 - May 1980
Randy L. Crane and Harvey D. Goff Nov. 1980 23 p refs
(Contract DAAJ02-77-C-0026; DA Proj. 1L2-62209-AH-76)
(AD-A093515; FSI-1140; USAAVRADCOM-TR-80-D-22) Avail: NTIS HC A02/MF A01 CSCL 13/5

A one-piece helicopter external cargo sling apex fitting was developed from Kevlar 29 to meet Army requirements for a lightweight, nonmetallic fitting that will facilitate cargo hook movement of sling-assisted loads. This report outlines the processes of material selection, design concepts, manufacturing methods, and testing undertaken to develop a versatile unit that meets or exceeds all previous criteria. GRA

N81-18050# Information Spectrum, Inc., Warminster, Pa.
COMPILATION OF ENERGY EFFICIENT CONCEPTS IN ADVANCED AIRCRAFT DESIGN AND OPERATIONS. VOLUME 2: ABSTRACT DATA BASE Final Report, 10 Mar. - 5 Nov. 1980
Milton Clyman, Sheldon J. Einhorn, and Richard S. Schultz 5 Nov. 1980 435 p refs
(Contract N62269-80-C-0200)
(AD-A094226; NADC-79239-60-Vol-2) Avail: NTIS HC A19/MF A01 CSCL 01/3

The technologies necessary to support next generation (1990+) air vehicle design and operation concepts that will reduce the requirements for natural petroleum derived energy are considered in the Advanced Concepts Data Base which consists of 599 abstracts listed as 948 entries. The data base abstracts are arranged into 11 areas of R&D effort as follows: synthetic fuels, liquid hydrogen fuels, other fuels; gas turbines, nuclear propulsion, advanced propulsion; aerodynamics; structures and materials; flight performance management; advanced and unconventional systems; and energy efficient operation. A.R.H.

N81-18051# Information Spectrum, Inc., Warminster, Pa.
COMPILATION OF ENERGY EFFICIENT CONCEPTS IN ADVANCED AIRCRAFT DESIGN AND OPERATIONS. VOLUME 1: TECHNICAL REPORT Final Report, 10 Mar. - 5 Nov. 1980
Milton Clyman, Sheldon J. Einhorn, and Richard S. Shultz 5 Nov. 1980 101 p refs
(Contract N62269-80-C-0200)
(AD-A094225; NADC-79239-60-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 01/3

This final report (contained in two volumes) presents the results of research into published literature. The search addressed the technologies necessary to support next generation (1990+) vehicle design and operation concepts that will reduce the requirement for natural petroleum-derived energy. The Advanced Concepts Evaluation (ACE) Data Base consists of 599 unique abstracts listed as 948 entries. The ACE Data Base is arranged into eleven areas of R D effort, each subdivided into Navy and non-Navy funded programs. Volume 1 includes introduction, Data Bases searched, research methodology for creation of the ACE Data Base, summary of search results, conclusions and recommendations. This volume contains an appendix of search strategies utilized. GRA

N81-18052# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
PRELIMINARY AIRWORTHINESS EVALUATION OH-58C HELICOPTER CONFIGURED WITH A MAST MOUNTED SIGHT Final Report
John A. Bishop, Marvin L. Hanks, Tom P. Benson, and Arthur M. Arrigo May 1980 76 p refs
(AD-A094172; USAAEFA-78-09) Avail: NTIS HC A05/MF A01 CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a preliminary airworthiness evaluation of the OH-58C helicopter with a mast mounted sight and Bell Helicopter, Textron Model 570B three-axis stability and control augmentation system. The evaluation was completed in two phases at the Bell Helicopter Engineering Flight Research Center, Arlington, Texas (elevation 630 ft). Phase 1 consisted of an evaluation of a dummy mast mounted sight installed on an instrumented helicopter. This phase was conducted between 15 and 30 October 1980 and 12 flights were flown for a total of 9.7 productive hours. Phase 2 consisted of a qualitative assessment of the handling qualities of the OH-58C configured with the operational Rockwell International sight. This phase was completed on 30 November 1980 in two flights for 1.5 productive test flight hours. The overall evaluation indicated that the OH-58C handling qualities with installed mast mounted sight and three-axis SCAS were satisfactory within the flight envelope tested. No problems were noted that will prevent future operational testing of the system. The addition of a three-axis SCAS significantly improved the OH-58C handling qualities, particularly in low speed flight, and is an enhancing characteristic. GRA

N81-18053# Boeing Vertol Co., Philadelphia, Pa.
HELICOPTER ICING REVIEW Final Report, 30 Sep. 1978 - 31 Jul. 1980
A. A. Peterson and L. U. Dadone Sep. 1980 249 p refs
(Contract DOT-FA78WA-4258)
(AD-A094175; D210-11583-1; FAA-CT-80-210) Avail: NTIS HC A11/MF A01 CSCL 01/3

The development of techniques and criteria permitting the

release of a helicopter into known (i.e., forecast) icing situations is actively being investigated by both military and civilian agencies through ongoing test programs and study efforts. As part of this overall effort, helicopter icing characteristics, available ice protection technology, and test techniques are discussed in this technical treatment. Recommendations are provided in the areas of icing certification procedures and icing research. One of the key issues addressed in this report is the test environment, i.e., the use of inflight evaluation in natural icing only, or, the use of a simulated icing environment to supplement and/or expand the certification envelope. Involved in this issue is the shape (and extent) of the rotor ice (natural vs simulated) as it affects the aerodynamics and dynamics of the rotor system, together with the shedding characteristics as it affects the behavior and safety of the complete vehicle. GRA

N81-18054# Naval Ship Research and Development Center, Bethesda, Md.
SOME DYNAMIC PROPERTIES OF RIGID TWO-BLADED FULLY GIMBALLED TIP-JET HELICOPTER ROTOR WITH CIRCULATION CONTROL
Harvey R. Chaplin Aug. 1980 35 p refs
(ZF66412001)
(AD-A094031; DTNSRDC/TM-16-80-16) Avail: NTIS HC A03/MF A01 CSCL 20/4

Simplified analyses are carried out for the motions of a simple rigid two-bladed fully gimballed rectangular rotor rotating at constant speed about a stationary center point and about a center point translating at a low constant advance ratio. (The term 'fully gimballed' means that hub moments about all axes are zero.) It is concluded that: the rotor can be rendered dynamically stable by appropriate mass balancing. In a particular example considered, the mass balancing was estimated to increase the rotor weight by about 20%. The steady state motion about a translating center due to first harmonic moments induced by translation is a wobbling motion with the principal axis of rotation describing a cone about its mean position at twice to rotor rotational frequency. A circulation control system can control total rotor lift and can cause precession of the mean position of the principal rotational axis to any desired orientation. It cannot, however, influence the amplitude of the steady state wobble. GRA

N81-17987*# Rockwell International Corp., Thousand Oaks, Calif. North American Aircraft Div.
A STUDY OF WING BODY BLENDING FOR AN ADVANCED SUPERSONIC TRANSPORT
T. P. Goebel, E. Bonner, and D. A. Robinson *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 149-189 refs (For primary document see N81-17981 09-01)
(Contract NAS1-15720)
Avail: NTIS HC A23/MF A01 CSCL 01C

N81-17989*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ANALYTIC DEVELOPMENT OF IMPROVED SUPERSONIC *CRUISE AIRCRAFT BASED ON WIND TUNNEL DATA*
R. L. Roensch and G. S. Page *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 205-227 refs (For primary document see N81-17981 09-01)
(Contract NAS1-14621)
Avail: NTIS HC A23/MF A01 CSCL 01C

N81-17990*# National Aeronautics and Space Administration. *Langley Research Center, Hampton, Va.*
SUPERSONIC WINGS WITH SIGNIFICANT LEADING-EDGE THRUST AT CRUISE
A. Warner Robins, Harry W. Carlson, and Robert J. Mack *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 229-246 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01A

N81-17991*# *Calspan Advanced Technology Center, Buffalo, N.Y.*
FLYING QUALITIES DESIGN CRITERIA APPLICABLE TO *SUPERSONIC CRUISE AIRCRAFT*
Charles R. Chalk *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 251-267 refs (For primary document see N81-17981 09-01)
(Contract F33615-78-C-3602)
Avail: NTIS HC A23/MF A01 CSCL 01C

N81-17998*# Lockheed-California Co., Burbank.
EFFECTS ON INLET TECHNOLOGY ON CRUISE SPEED SELECTION
L. H. Bangert, D. M. Santman, G. Horie, and L. D. Miller *In* NASA. Langley Research Center Supersonic Res. 1979, Pt. 1 Mar. 1980 p 391-411 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 01C

N81-18006*# Lockheed-California Co., Burbank.
STRUCTURAL CONCEPT TRENDS FOR COMMERCIAL SUPERSONIC CRUISE AIRCRAFT DESIGN
I. F. Sakat, G. W. Davis, and B. Saelman *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 563-587 refs 2 Vol. (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18007*# Douglas Aircraft Co., Inc., Long Beach, Calif.
OPPORTUNITIES FOR STRUCTURAL IMPROVEMENTS FOR AN ADVANCED SUPERSONIC TRANSPORT VEHICLE
J. E. Fischler *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 589-616 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18008*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SUPERSONIC CRUISE RESEARCH AIRCRAFT STRUCTURAL STUDIES: METHODS AND RESULTS
J. Sobieszczanski-Sobieski, David Gross (Kentron International, Hampton, Va.), William Kurtze, Jerry Newsom, Gregory Wrenn (Kentron International, Hampton, Va.), and William Greene (Kentron International, Hampton, Va.) *In its* Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 617-656 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18009*# National Aeronautics and Space Administration. *Langley Research Center, Hampton, Va.*
AN ASSESSMENT OF BUFFER STRIPS FOR IMPROVING DAMAGE TOLERANCE
C. C. Poe, Jr. and John M. Kennedy *In its* Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 657-673 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18016*# *Boeing Commercial Airplane Co., Seattle, Wash.*
OVERVIEW OF BOEING SUPERSONIC TRANSPORT EFFORTS, 1971 - 1979
A. Sigalla *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 821-832 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18017*# *Boeing Commercial Airplane Co., Seattle, Wash.*
A FAMILY OF SUPERSONIC AIRPLANES: TECHNICAL AND ECONOMIC FEASIBILITY
Frank D. Neumann and Jerry W. Whitten In NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 833-854 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18019*# McDonnell-Douglas Corp., Long Beach, Calif.
TECHNOLOGY DEVELOPMENT STATUS AT MCDONNELL DOUGLAS
William T. Rowe *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 873-888 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

N81-18022*# *Rockwell International Corp., Los Angeles, Calif.* North American Aircraft Div.
SUPERSONIC CRUISE VEHICLE RESEARCH/BUSINESS JET

Robert J. Kelly *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 935-949 (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography.

N81-18055# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
WIND SHEAR SYSTEMS IMPLEMENTATION PLAN, BENEFIT/COST STUDY Final Report, 19 Aug. 1979 - Jun. 1980
Byron F. Bond Aug. 1980 80 p refs
(Contract DOT-FA79WA-4279)
(AD-A094168; FAA-RD-80-103) Avail: NTIS
HC A05/MF A01 CSCL 01/4

Since July 1973 there have been eight U.S. air carrier accidents attributed to encounters with strong low-level wind shears during terminal flight operations. The FAA research and development effort has taken a threefold approach to the wind shear problem: (1) developing and implementing improved forecasting techniques and procedures for predicting and reporting low-level wind shear in the terminal area; (2) placing wind shear detection equipment on the ground and transmitting information to the pilot; and (3) installing equipment aboard the aircraft that would provide the pilot with wind shear information in 'real time . The results of the latter effort, i.e., airborne wind shear systems and techniques are evaluated as to their relative benefits and costs both to the user and to the FAA. Ground speed is a major input variable to many of the candidate airborne wind shear systems. Eight techniques for providing ground speed are evaluated and cost comparisons are documented. Also evaluated are three self contained wind shear systems that do not rely on ground speed as a reference and a head-up display for displaying wind shear data. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N81-18056*# General Electric Co., Evendale, Ohio. Aircraft Engine Group.
ENERGY EFFICIENT ENGINE: FLIGHT PROPULSION SYSTEM PRELIMINARY ANALYSIS AND DESIGN Topical Report, Jan. - Nov. 1978
R. P. Johnston, R. S. Beitler, R. O. Bobinger, C. L. Broman, R. D. Gravitt, H. Heineke, P. R. Holloway, J. S. Klem, D. O. Nash, and P. Ortiz Jun. 1980 276 p refs
(Contract NAS3-20643)
(NASA-CR-159583; R79AEG623) Avail: NTIS
HC A12/MF A01 CSCL 21E

The characteristics of an advanced flight propulsion system (FPS), suitable for introduction in the late 1980's to early 1990's, was more fully defined. It was determined that all goals for efficiency, environmental considerations, and economics could be met or exceeded with the possible exception of NOx emission. In evaluating the FPS, all aspects were considered including component design, performance, weight, initial cost, maintenance cost, engine system integration (including nacelle), and aircraft integration considerations. The current FPS installed specific fuel consumption was reduced 14.2% from that of the CF6-50C reference engine. When integrated into an advanced, subsonic, study transport, the FPS produced a fuel burn savings of 15 to 23% and a direct operating cost reduction of 5 to 12% depending on the mission and study aircraft characteristics relative to the reference engine. E.D.K.

N81-18057# Michigan Univ., Ann Arbor. W. E. Lay Automotive Lab.
LIGHT AIRCRAFT ENGINES, THE POTENTIAL AND PROBLEMS FOR USE OF AUTOMOTIVE FUELS. PHASE 1: LITERATURE SEARCH Final Report, Oct. 1979 - Sep. 1980
D. J. Patterson, K. Morrison, M. Remondino, and T. Slopsema Dec. 1980 122 p refs
(Contract DOT-FA79NA-6083)
(AD-A094154; FAA-CT-81-150) Avail: NTIS
HC A06/MF A01 CSCL 21/4

A comprehensive data research and analysis for evaluating the use of automotive fuels as a substitute for aviation grade fuel by piston-type general aviation aircraft engines is presented. Historically known problems and potential problems with fuels were reviewed for possible impact relative to application to an aircraft operational environment. This report reviews areas such as: fuel specification requirements, combustion knock, preignition, vapor lock, spark plug fouling, additives for fuel and oil, and storage stability. GRA

N81-18058# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
INTERAGENCY NITRIC OXIDE MEASUREMENT INVESTIGATION: AEDC RESULTS FOR PHASE 3. (COMPARISON OF OPTICAL AND PROBE MEASUREMENTS OF NITRIC OXIDE CONCENTRATION IN COMBUSTORS)
J. D. Few, H. S. Lowry, III, and W. K. McGregor AEDC Jan. 1981 62 p refs Sponsored by Air Force
(AD-A094258; AEDC-TR-80-22) Avail: NTIS
HC A04/MF A01 CSCL 14/2

The purpose of Phase 3 of this program was to measure NO concentration on three successively more complicated combustion systems using both optical and probe techniques. The results of all measurements, both probe and optical, were compared and analyzed. Generally, the NO concentrations determined by the optical method were no larger than 30 percent above the values obtained with probes for a methane/air flat-frame burner, a propane/air swirl combustor, and a liquid-fueled simulated jet engine combustor. Close examination of the data revealed that probe results were influenced by some chemical reaction. The probes were designed for subsonic, atmospheric pressure flows, and arguments are presented to show that the agreement found in these experiments need not be expected in near sonic or supersonic flow using the same probe design.GRA

N81-18059# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE REACTING AND NON-REACTING FLOW CHARACTERISTICS OF SOLID RAM-JETS
Winston Elliott Scott Sep. 1980 80 p refs
(AD-A094567) Avail: NTIS HC A05/MF A01 CSCL 21/5

An investigation was conducted to determine the relationship between the non-reacting and the reacting flow characteristics of solid fuel ramjets. Polymethylmethacrylate fuel grains were burned in a ramjet motor on a thrust stand. Combustion efficiency, regression rate profile and pressures were determined for the reacting flows and compared to profiles obtained in non-reacting flows for velocity, pressure, and near-wall and centerline turbulence intensity. Near-wall turbulence profiles were in agreement with the fuel regression profiles obtained in reacting flows. Combustion efficiency was found to be a strong function of mixture ratio. Near-wall mixing significantly increased fuel regression rate. GRA

N81-17995*# General Electric Co., Lynn, Mass.
VCE TEST BED ENGINE FOR SUPERSONIC CRUISE RESEARCH
J. W. Vdoviak and J. A. Ebacher *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 347-356 (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 21E

N81-17996*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
VARIABLE STREAM CONTROL ENGINE FOR ADVANCED SUPERSONIC AIRCRAFT DESIGN UPDATE
Richard B. Hunt and Robert A. Howlett *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 347-370 refs (For primary document see N81-17981 09-01)
(Contract NAS3-21389)
Avail: NTIS HC A23/MF A01 CSCL 21E

N81-17997*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
PROGRESS WITH VARIABLE CYCLE ENGINES
John S. Westmoreland *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 371-390 refs (For primary document see N81-17981 09-01)
(Contracts NAS3-20048; NAS3-20061; NAS3-20602)
Avail: NTIS HC A23/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-18060*# Lear Siegler, Inc., Santa Monica, Calif. Astronics Div.
DEVELOPMENT AND EVALUATION OF AUTOMATIC LANDING CONTROL LAWS FOR POWER LIFT STOL AIRCRAFT Final Report
B. Feinreich and G. Gevaert Jan. 1981 258 p
(Contract NAS2-10324)
(NASA-CR-152399) Avail: NTIS HC A12/MF A01 CSCL 01C

A series of investigations were conducted to generate and verify through ground bases simulation and flight research a data base to aid in the design and certification of advanced propulsive lift short takeoff and landing aircraft. Problems impacting the design of powered lift short haul aircraft that are to be landed automatically on STOL runways in adverse weather were examined. An understanding of the problems was gained by a limited coverage of important elements that are normally included in the certification process of a CAT 3 automatic landing system. T.M.

N81-18061*# National Aeronautics and Space Administration, Washington, D. C.
THE HIGH LIFT CHARACTERISTICS IN THE CASE OF THE V-WING CONCEPT
H. Zimmer Nov. 1980 41 p refs Transl. into ENGLISH "Das hochauf triebsverhalten beim rautenfluegelkonzept" Rept. DGLR Paper 78-114 West Germany, 30 Aug. 1978 43 p Presented at Deutscher Luft-und Raumfahrt-Kongress, Darmstadt, West Germany, 19-23 Sep. 1978 Original language document announced as A79-14072 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Dornier-Werke G.m.b.H., Friedrichshafen, West Germany
(Contract NASw-3198)
(NASA-TM-75872) Avail: NTIS HC A03/MF A01 CSCL 01C

Theoretical experimental investigation of a diamond wing concept were carried out. Experimental results are available for two models with two low speed channels and two high speed channels, with various parameters varied. The expected reduction of the induced and the wave resistance and an increase in the maximum lift were confirmed by previous results. In addition, structural calculations for a hypothetical full scale version were carried out. According to the stresses and deformations determined, the wing concept should also be able to control the loads. E.D.K.

N81-18062# Analytic Sciences Corp., Reading, Mass.
RESEARCH IN MULTIRATE ESTIMATION AND CONTROL Annual Report, 1 May 1979 - 1 May 1980
Douglas P. Glasson 20 Dec. 1980 124 p refs
(Contract N00014-79-C-0431)
(AD-A094070; TASC-TR-1356-1) Avail: NTIS HC A06/MF A01 CSCL 12/1

A new approach to multirate control system synthesis based on optimal estimation and control theory was developed. The new techniques obviate dimensionality problems typical of classically based design techniques and offer a systematic procedure for designing to desired closed-loop specifications. Mathematical derivations of the optimal multirate state estimator, regulator, and proportional-plus-integral controllers are presented. The transient response and robustness properties of multirate systems designed by the present techniques are investigated through examples. GRA

N81-18063 Stanford Univ., Calif.
DESIGN FOR ACTIVE AND PASSIVE FLUTTER SUPPRESSION AND GUST ALLEVIATION Ph.D. Thesis
Mordechay Karpel 1980 117 p
Avail: Univ. Microfilms Order No. 8103527

The control techniques are ased on a rational approximation of the unsteady aerodynamic loads in the entire Laplace domain, which yields matrix equations of motion with constant coefficients. Some existing rational approximation schemes were reviewed, the matrix Pade approximant was modified, and a new technique which yields a minimal number of augmented states for a desired accuracy is presented. The state space aeroelastic model was used to design an active control system for simultaneous flutter suppression and gust alleviation. The design target is for a continuous controller which transfers some measurements taken on the vehicle to a control command applied to a control surface. The control parameters are constant and they are optimized to mimimize any desired combination of gust response parameters in a way that assures stability over the range of varying aerodynamic parameters in the entire flight envelope. Structural modifications were formulated in a way which enables the treatment of passive flutter suppression means with the same procedures by which active systems are designed. Dissert. Abstr.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N81-18064*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
PRELIMINARY DESIGN OF A SUPERCONDUCTING COIL ARRAY FOR NASA PROTOTYPE MAGNETIC BALANCE M.S. Thesis
Mohammad M. Alishahi May 1980 67 p refs
(Grant NsG-1356)
(NASA-CR-164027) Avail: NTIS HC A04/MF A01 CSCL 14B

Using a computer program a partly optimized configuration for a supeconducting version of side and lift coil system of NASA-MIT prototype is presented. Cable size for the mentioned coils and also for superconducting drag and magnetizing coils regarding the overall computed field was determined. T.M.

N81-18065*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
SCALE MODEL STUDIES FOR IMPROVEMENT OF FLOW PATTERNS OF A LOW-SPEED TUNNEL Progress Report, 1 Aug. 1980 - 28 Feb. 1981
P. S. Barna Mar. 1981 29 p
(Grant NsG-1563)
(NASA-CR-164030) Avail: NTIS HC A03/MF A01 CSCL 14B

Flow along a nacelle was investigated with and without an orifice plate inserted into the airstream. The flow became more uniform in transit through the orifice when compared with the

upstream flow and remained more uniform immediately downstream from the orifice. No improvement was found farther downstream with or without the orifice plate. Various windmills were studied to determine their effects on the downstream flow pattern. The windmill retarded flow velocity inside the circle inscribed by the tip of free wheeling propellers (used as substitute windmills), while the main stream passed over the blades seemingly unrestricted and without showing any increase in diameter. Results show that by varying a torque, the flow across a windmill can be effectively redistributed, an effect that could be gainfully employed in situations where the main flow into a diffuser is concentrated near the center. The construction of the 1/24 scale model tunnel and the velocity transverses obtained on the model are discussed. The transverses indicate that the velocity distribution may be considered worse in the vertical than in the horizontal plane. A.R.H.

N81-18066# Air Force Human Resources Lab., Brooks AFB, Tex. Operating Training Div.
ADVANCED FLIGHT SIMULATOR: UTILIZATION IN A-10 CONVERSION AND AIR-TO-SURFACE ATTACK TRAINING Final Report
Thomas H. Gray, Edward K. Chun, Harold D. Warner (Dayton Univ. Res. Inst.), and James L. Eubanks (Dayton Univ. Res. Inst.) Jan. 1981 191 p refs
(AF Proj. 1123)
(AD-A094608; AFHRL-TR-80-20) Avail: NTIS HC A09/MF A01 CSCL 05/9

The purposes of this research were to develop transition and surface attack simulator training programs for novice A-10 pilots and to determine simulator features and capabilities required for effective training in the air-to-surface (A/S) mission. These goals were refined to four specific objectives: development of a transition and surface attack syllabus; generation of objective performance measurement algorithms; determination of design requirements for instructor stations; and assessment of the utility of advanced instructional features. These objectives were accomplished using A-10 Instructor Pilots and four classes of 'B' course students who had recently completed Undergraduate Pilot Training and Fighter Lead-In-School. Each class received two blocks of instruction on the Advanced Simulator for Pilot Training (ASPT). The first block consisted of 4 to 8 hours of conversion training with primary emphasis on traffic pattern work. The second block of training was composed of 4 to 7 hours of A/S weapons delivery (i.e., dive bombing and strafe). The key findings were: (1) for the initial phases of weapons delivery training, the transfer of training from the ASPT to the A-10 is nearly 100 percent, therefore, in the early phases of A/S training, one simulator mission can effectively replace one aircraft mission, thus allowing actual flying time to be transferred to other phases of training; (2) objective assessments of piloting and weapons delivery skills are highly useful in A-10 training; (3) improvements are needed in the display and controls at the A-10 instructor station. GRA

N81-18067# Naval Postgraduate School, Monterey, Calif.
VALIDATION OF A TWO-DIMENSIONAL PRIMITIVE VARIABLE COMPUTER CODE FOR FLOW FIELDS IN JET ENGINE TEST CELLS Final Report
Paul J. Mallon, Patrick J. Hickey, and David W. Netzer Oct. 1980 73 p refs Sponsored by Navy
(AD-A094615; NPS67-80-014) Avail: NTIS HC A04/MF A01 CSCL 09/2

Pressure and velocity data were collected in a full scale jet engine test cell in order to validate the predictive accuracy of a two dimensional and axisymmetric primitive variable computer code. It was found that the model reasonably predicted the velocity profiles in the augmentor tube. Inaccuracy increased at higher engine thrust settings at positions far downstream in the augmentor tube. Predicted pressure profiles were reasonable but the magnitudes were in considerable error at high flow rates. GRA

N81-17992*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ADVANCED SUPERSONIC TRANSPORT FIXED-BASE SIMULATOR EVALUATIONS AT LANDING APPROACH
John B. Feather *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 269-283 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 14B

N81-17993*# Lockheed-California Co., Burbank.
SIMULATOR INVESTIGATION OF ARROW-WING LOW-SPEED HANDLING QUALITIES
Ben T. Averett *In* NASA. Langley Res. Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 285-298 ref (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 14B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-18068*# National Aeronautics and Space Administration, Washington, D. C.
FIFTEENTH ANNIVERSARY OF FIRST SPACE WALK
Ye. V. Khrunov Oct. 1980 11 p refs Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 2, Mar. - Apr. 1980 p 8-11 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76435) Avail: NTIS HC A02/MF A01 CSCL 22A

The history of space walks is recounted. Their importance for the development of the space program is discussed. T.M.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N81-18069*# National Aeronautics and Space Administration, Washington, D. C.
USE OF INFORMATION ON THE MOTION OF SPACECRAFT AROUND THE CENTER OF BODIES IN THE UNDERTAKING OF DETECTING SOURCES OF X-RAY AND GAMMA RADIATION
N. A. Eysmont Jun. 1980 17 p refs Transl. into ENGLISH of "Ispol'novaniye Informatsii o Dvizhenii Kosmicheskogo Apparata Okolo Tsentra Mass v Zadache Lokalizatsii Istochnikov Rengenovskikh i Gamma-Izlucheniy" Rept. Pr-378 Moscow, 1977 p 1-17 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-76205; Pr-378) Avail: NTIS HC A02/MF A01 CSCL 22A

The problem of localizing sources of X-ray and gamma surges can be solved vis the installation of suitable monitors on several dispersed spacecraft. In this manner, determination of the coordinates of the source is possible only with the use of four spacecraft. In the case of the use of 3 or 2 spacecraft, it is necessary to use supplementary information. Data on the motion of a spacecraft around the center of a mass was used in the capacity of such information. T.M.

N81-18070# Federal Electric Corp., Vandenberg AFB, Calif.
TRAJECTORY RECONSTRUCTION AND ANALYSIS METHODOLOGY. INTEGRATION OF THE TRAJECTORY AND TRANSITION MATRICES FOR POWERED FLIGHT Final Report
Gene T. Thompson Vandenberg AFB, Calif. AFSC May 1980 42 p refs
(Contract F04703-77-C-0111)
(AD-A094302; AS300-T-80-16; WSMC-TR-80-2) Avail: NTIS HC A03/MF A01 CSCL 16/2

TRAM or the Trajectory Reconstruction and Analysis Method is prototype software under development at the Western Space and Missile Center that will render improvements in the range's capability for Best Estimate of Trajectory Prediction. This report compares the modified Euler and Runge-Kutta methods of integrating the missile's powered flight trajectory and demonstrates that the Runge-Kutta is best. The report also compares the

Runge-Kutta and the Adams-Moulton integrators in the TRAM transition matrix computation and again determines that the Runge-Kutta produces less error. Spline polynomials were also investigated as an interpolation technique in order to reduce integration time. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N81-18987*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER 10 AND 11 MISSION SUPPORT
R. E. Nevarez *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 17-21 ref (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 14B

N81-18988*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT
N. Fanelli and H. Nance *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 22-26 (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-18071# RAND Corp., Santa Monica, Calif.
ALMOST EVERYTHING ONE NEEDS TO KNOW ABOUT IMAGE MATCHING SYSTEMS
Joseph A. Ratkovic and Edmund H. Conrow (Aerospace Corp., El Segundo, Calif.) Aug. 1980 29 p refs
(P-6518) Avail: NTIS HC A03/MF A01

The missile map matching problems for guidance updating or target homing is presented. The problem consists of locating the position of a sensor image relative to a reference map which is stored onboard the vehicle's computer. Once the match location is found the relative location between the two map centers can be used to update the vehicle's navigational position. The two important performance considerations are the avoidance of false fixes as measured by their frequency of occurrence and the accuracy with which the position fix can be made. The overall design and evaluation of map matching systems are described. The layout of a typical system design is presented. The system parameters associated with the reference data, sensor environment and vehicle were integrated to determine a model of the image dynamics. This model used in conjunction with a signature prediction model was used to construct the reference map or set of reference maps to be stored on the vehicle. T.M.

N81-18072*# General Dynamics/Convair, San Diego, Calif.
GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY
Final Report
Jun. 1980 72 p Prepared in cooperation with Communications Satellite Corp., Clarksburg, Md.
(Contract NAS8-33527)
(NASA-CR-161647; GDC-GPP-79-006-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 22B

The results of a geostationary platform concept analysis are summarized. Mission and payloads definition, concept selection, the requirements of an experimental platform, supporting research and technology, and the Space Transportation System interface requirements are addressed. It is concluded that platforms represent a logical extension of current trends toward larger, more complex, multifrequency satellites. Geostationary platforms offer significant cost savings compared to individual satellites, with the majority of these economies being realized with single Shuttle launched platforms. Further cost savings can be realized, however, by having larger platforms. Platforms accommodating communications equipment that operates at multiple frequencies and which provide larger scale frequency reuse through the use of large aperture multibeam antennas and onboard switching maximize the useful capacity of the orbital arc and frequency spectrum. Projections of market demand indicate that such conservation measures are clearly essential if orderly growth is to be provided for. In addition, it is pointed out that a NASA experimental platform is required to demonstrate the technologies necessary for operational geostationary platforms of the 1990's. M.G.

N81-18073*# General Dynamics/Convair, San Diego, Calif.
GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY. VOLUME 2: TECHNICAL, BOOK 1
Final Report
Jun. 1980 210 p refs Prepared in cooperation with Communications Satellite Corp., Clarksburg, Md.
(Contract NAS8-33527)
(NASA-CR-161648; GDC-GPP-79-006-Vol-2-Bk-1) Avail: NTIS HC A10/MF A01 CSCL 22B

The initial selection and definition of operational geostationary platform concepts is discussed. Candidate geostationary platform missions and payloads were identified from COMSAT, Aerospace, and NASA studies. These missions and payloads were cataloged; classified with to communications, military, or scientific uses; screened for application and compatibility with geostationary platforms; and analyzed to identify platform requirements. Two platform locations were then selected (Western Hemisphere - 110 deg W, and Atlantic - 15 deg W), and payloads allocated based on nominal and high traffic models. Trade studies were performed leading to recommendation of selected concepts. Of 30 Orbit Transfer Vehicle (OTV) configuration and operating mode options indentified, 18 viable candidates compatible with the operational geostationary platform missions were selected for analysis. Each was considered using four platform operational modes - 8 or 16 year life, and serviced or nonserviced, providing a total of 72 OTV/platform-mode options. For final trade study concept selection, a cost program was developed considering payload and platform costs and weight; transportation unit and total costs for the shuttle and OTV; and operational costs such as assembly or construction time, mating time, and loiter time. Servicing costs were added for final analysis and recommended selection. M.G.

N81-18074*# General Dynamics/Convair, San Diego, Calif.
GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY. VOLUME 2: TECHNICAL, BOOK 2
Final Report
Jun. 1980 413 p refs Prepared in cooperation with Communications Satellite Corp., Clarksburg, Md
(Contract NAS8-33527)
(NASA-CR-161649; GDC-GPP-79-006-Vol-2-Bk-2) Avail: NTIS HC A18/MF A01 CSCL 22B

A selected concept for a geostationary platform is defined in sufficient detail to identify requirements for supporting research and technology, space demonstrations, GFE interfaces, costs, and schedules. This system consists of six platforms in geostationary orbit (GEO) over the Western Hemisphere and six over the Atlantic, to satisfy the total payload set associated with the nominal traffic model. Each platform is delivered to low Earth orbit (LEO) in a single shuttle flight, already mated to its LEO to GEO transfer vehicle and ready for deployment and transfer to GEO. An alternative concept is looked at briefly for comparison of configuration and technology requirements. This alternative consists of two large platforms, one over the Western Hemisphere consisting of three docked modules, and one over the Atlantic (two docked modules), to satisfy a high traffic model. The modules are full length orbiter cargo bay payloads, mated at LEO to orbital transfer vehicles (OTVs) delivered in other shuttle flights, for transfer to GEO, rendezvous, and docking. A preliminary

feasibility study of an experimental platform is also performed to demonstrate communications and platform technologies required for the operational platforms of the 1990s. M.G.

N81-18075*# General Dynamics/Convair, San Diego, Calif.
GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY. VOLUME 2: TECHNICAL, BOOK 3 Final Report
Jun. 1980 242 p Prepared in cooperation with Communications Satellite Corp., Clarksburg, Md.
(Contract NAS8-33527)
(NASA-CR-161650; GDC-GPP-79-006-Vol-2-Bk-3) Avail: NTIS HC A11/MF A01 CSCL 22B

The supporting research and technology, and space demonstrations required to support the 1990s operational geostationary platforms are identified. Also the requirements on and interfaces with the Space Transportation System hardware elements supporting the geostationary platform program, including the shuttle, orbital transfer vehicles, teleoperator, etc., are investigated to provide integrated support requirements. Finally, a preliminary evaluation of the practicability and capabilities of an experimental platform from the standpoint of technology, schedule, and cost is given. M.G.

N81-18076*# General Dynamics/Convair, San Diego, Calif.
GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY. VOLUME 2A: APPENDIXES, BOOK 1 Final Report
Jun. 1980 360 p Prepared in cooperation with Communications Satellite Corp., Clarksburg, Md.
(Contract NAS8-33527)
(NASA-CR-161651; GDC-GPP-79-006-Vol-2A-Bk-1) Avail: NTIS HC A16/MF A01 CSCL 22B

Appendixes addressing various aspects of a geostationary platform concepts definition study are given. Communication platform traffic requirements, video conferencing forecast, intersatellite link capacity requirements, link budgets, payload data, payload assignments, and platform synthesis are addressed. M.G.

N81-18077*# General Dynamics/Convair, San Diego, Calif.
GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION STUDY. VOLUME 2A: APPENDIXES, BOOK 2 Final Report
Jun. 1980 197 p refs Prepared in cooperation with Communications Satellite Corp., Clarksburg, Md.
(Contract NAS8-33527)
(NASA-CR-161652; GDC-GPP-79-006-Vol-2A-Bk-2) Avail: NTIS HC A09/MF A01 CSCL 22B

Various investigations and support data concerning geostationary platform feasibility are presented. Servicing flight analyses, platform cost model runs, and funding spread analyses are included. In addition, investigations of the radiation environment at synchronous altitude and its effects on satellite communication are reported. M.G.

N81-18078*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EQUILIBRIUM AND STABILITY OF A SATELLITE INFLUENCED BY GRAVITATIONAL AND AERODYNAMIC TORQUES
Zachary J. Galaboff Jan. 1981 77 p refs
(NASA-TM-82401) Avail: NTIS HC A05/MF A01 CSCL 22B

A circular orbit and constant atmospheric density was assumed. A computer program which determines equilibrium attitudes and the associated eigenvalues of these attitudes is presented. Demonstration of the use of this program was made using the former Skylab satellite as an example. T.M.

N81-18079*# National Aeronautics and Space Administration, Washington, D. C.
PLAN FOR PLANET-A SATELLITE
Dec. 1980 11 p Transl. into ENGLISH "Planet-A Keikaku" Japan 6 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Space Research Lab., Tokyo Univ., Japan
(Contract NASw-3198)
(NASA-TM-76456) Avail: NTIS HC A02/MF A01 CSCL 22B

A description is given of the plan for Planet-A which will be launched by Japan in January 1985. In 1986 this probe will approach Halley's Comet. The tests to be made by this probe are discussed. Author

N81-18080# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
P78-2 SCATHA PRELIMINARY DATA ATLAS
E. G. Mullen, H. B. Garrett, D. A. Hardy, and E. C. Whipple (California Univ. at San Diego, La Jolla) 11 Aug. 1980 42 p refs
(AF Proj. 7661)
(AD-A094122; AFGL-TR-80-0241; AFGL-ERP-712) Avail: NTIS HC A03/MF A01 CSCL 20/8

A preliminary study of the 100 eV to approx. 1 MeV plasma environment encountered by the P78-2 Spacecraft Charging at High Altitudes (SCATHA) Satellite during its initial operation period was conducted. Forty-four days of 10 min averages of the four moments of the electron and low distribution functions calculated from the SC 5 and SC 9 energetic particle measurements were analyzed to determine occurrence frequency, local time variation, geomagnetic activity variation, and L shell variation. The single and double Maxwellian parameters derived from the four moments were similarly analyzed. The interrelationships between the moments and derived parameters were computed and the results compared with the ATS 5 and ATS 6 atlas of Garrett et al (1980). Results of this analysis establish a baseline range for the SCATHA plasma environment. GRA

N81-18081# Naval Postgraduate School, Monterey, Calif.
HYDROGRAPHIC APPLICATIONS OF THE GLOBAL POSITIONING SYSTEM M.S. Thesis
Penny D. Dunn and John W. Rees, II Sep. 1980 229 p refs
(AD-A094556) Avail: NTIS HC A11/MF A01 CSCL 08/10

Global positioning satellites receivers have been tested under a variety of conditions and have demonstrated exceptional accuracy. The most portable of the Phase 1 development equipment is the manpack/vehicle user equipment (MVUE or Manpack). The purpose of this study was to determine if a manpack is suitably accurate for coastal hydrographic surveying at scales on the order of 1:20,000. The MVUE was placed aboard the Naval Postgraduate School Research Vessel (R/V) ACANIA and operated under survey conditions in Monterey Bay, California. This objective required the testing of the manpack developed by Texas Instruments, Inc., under varying survey conditions to determine the degradation of positional accuracy. The limit of the survey to which the unprocessed manpack data could be employed in a real-time operation was found to be 1:80,000 and smaller by the positioning error criteria of 0.5 mm to the scale of the survey (Umback, 1976). Application of differential techniques during the post-processing of the MVUE position data increased the limit of the survey scale to 1:40,000 using the same positioning criteria. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N81-18082*# National Aeronautics and Space Administration, Washington, D. C.
RADIO-WAVE PROPAGATION FOR SPACE COMMUNICATIONS SYSTEMS
Louis J. Ippolito Feb. 1981 63 p refs
(NASA-TP-1770; EC-4) Avail: NTIS HC A04/MF A01 CSCL 17B

The most recent information on the effects of Earth's atmosphere on space communications systems is reviewed. The design and reliable operation of satellite systems that provide the many applications in space which rely on the transmission of radio waves for communications and scientific purposes are dependent on the propagation characteristics of the transmission path. The presence of atmospheric gases, clouds, fog, precipitation, and turbulence causes uncontrolled variations in the signal characteristics. These variations can result in a reduction of the quality and reliability of the transmitted information. Models and other techniques are used in the prediction of atmospheric effects as influenced by frequency, geography, elevation angle, and type of transmission. Recent data on performance characteristics obtained from direct measurements on satellite links operating to above 30 GHz have been reviewed. Particular emphasis has been placed on the effects of precipitation on the Earth/space path, including rain attenuation, and ice particle depolarization. Other factors are sky noise, antenna gain degradation, scintillations, and bandwidth coherence. Each of the various propagation factors has an effect on design criteria for communications systems. These criteria include link reliability, power margins, noise contribution, modulation and polarization factors, channel cross talk, error rate, and bandwidth limitations. Author

N81-18994*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TELEMETRY DEGRADATION DUE TO A CW RFI INDUCED CARRIER TRACKING ERROR FOR THE BLOCK IV RECEIVING SYSTEM WITH MAXIMUM LIKELIHOOD CONVOLUTION DECODING
M. K. Sue *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 103-111 refs (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-18083 Stanford Univ., Calif.
CONTROL OF FLEXIBLE SPACECRAFT Ph.D. Thesis
John Alexander Breakwell 1980 100 p
Avail: Univ. Microfilms Order No. 8103488

A method is presented for maneuvering a flexible spacecraft from one position to another while leaving an arbitrary number of bending modes inactive at the end of the maneuver. The method combines standard fixed time LQG regulator control theory with a modal decompression of a flexible body. Further features of the method are that it uses minimum control effort and that it can be converted to a feedback form to deal with random disturbances and parameter uncertainties. Several examples are given to demonstrate the efficacy of the method, and results from a hardware experiment are presented. Dissert. Abstr.

N81-18084 California Univ., San Diego.
DIFFERENTIAL AND ACTIVE CHARGING RESULTS FROM THE ATS SPACECRAFT Ph.D. Thesis
Richard Christopher Olsen 1980 310 p
Avail: Univ. Microfilms Order No. 8103792

Aspects of spacecraft charging were studied in terms of the differential charging and artificial particle emission experiments on ATS 5 and ATS 6. It was found that differential charging of spacecraft surfaces generated large electrostatic barriers to spacecraft generated electrons, from photoemission, secondary emission, and thermal emitters. The electrostatic barrier was a potential minimum outside the charged spacecraft which causes low energy electrons to be trapped near the spacecraft. The large dish antenna on ATS 6 was identified as the source of the electrostatic barrier around the environmental measurements experimental package. Daylight charging on ATS 6 was shown to have behavior suggesting the dominance of differential charging on the absolute potential of the mainframe. Electron emission experiments on ATS 5 in eclipse charging environments showed that the electron emitter could partially or totally discharge the satellite, for the mainframe recharged negatively in a few 10's of seconds. Dissert. Abstr.

N81-18085*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SLOSH DYNAMICS OF A SPIN-STABILIZED SPACECRAFT COMPRISING OFF-AXIS TANKS FILLED PARTIALLY WITH LIQUID PROPELLANT
L. L. Fontenot 15 Feb. 1981 56 p refs
(Contract NAS7-100)
(JPL-Pub-80-97; NASA-CR-164004) Avail: NTIS HC A04/MF A01 CSCL 22B

The fundamental nonlinear equations of motion were derived and the specialized to a steady-state rotation of the vehicle about a given axis of rotation. A thrust about the spin axis was introduced. A perturbation solution was derived which linearizes the problem. The effect of the centrifugal and coriolis accelerations together with vorticity are implicitly taken into consideration in the formulation. A variational formulation of the associated boundary conditions is presented. For practical cases it is shown that the simple classical pendulum representation for slosh is not very appealing for a spinning spacecraft unless severe restrictions are allowed. T.M.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-18086 Stanford Univ., Calif.
THE BIOCHEMISTRY OF TRANSITION METALS: COPPER VANADIUM AND IRON Ph.D. Thesis
Patrick Frank 1980 253 p
Avail: Univ. Microfilms Order No. 8103507

A model for hemocyanin is proposed and its synthesis and

chemical behavior explored. The experiments described include an X-ray crystallographic structural study of (glycylglycy-O-methyl-L-histidine) Cu(2). Spectroscopic (uv-visible, CD, MCD), epr spectrometric and cyclic voltammetric experiments are also described. The nature of vanadium in the living cells of tunicates was investigated. Electron paramagnetic and proton magnetic resonance spectrometries were used to probe these cells and the results compared to model systems. The study of a modified copper protein was begun. X-ray absorption spectroscopy was used to obtain a detailed structural information on the iron containing site of the bacterial protein cytochrome c-551. It was found that the iron sulfur distance remains invariant at 2.34 A regardless of physiological oxidation state. These results are interpreted in terms of lowering the Franck-Condon barrier to electron transfer. The predictions to this effect based on model iron porphyrin complexes are thus verified. Dissert. Abstr.

N81-18087*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

LIQUID BOOSTER MODULE (LBM) PLUME FLOWFIELD MODEL Final Report

S. D. Smith Feb. 1981 23 p refs
(Contract NAS8-33976)
(NASA-CR-161646; LMSC-HREC-TR-D784066) Avail: NTIS HC A02/MF A01 CSCL 21H

A complete definition of the LBM plume is important for many Shuttle design criteria. The exhaust plume shape has a significant effect on the vehicle base pressure. The LBM definition is also important to the Shuttle base heating, aerodynamics and the influence of the exhaust plume on the launch stand and environment. For these reasons a knowledge of the LBM plume characteristics is necessary. A definition of the sea level LBM plume as well as at several points along the Shuttle trajectory to LBM, burnout is presented. T.M.

N81-18088# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.

TURBULENCE MODEL COMPARISONS FOR SHEAR LAYERS AND AXISYMMETRIC JETS

B. J. Walker Oct. 1979 130 p refs
(AD-A094438; AD-E950074; DRSMI/RD-80-1-TR) Avail: NTIS HC A07/MF A01 CSCL 12/1

Comparisons were made between experiment and theory to assess the capability of turbulent mixing models to predict the fluid flow-properties in the mixing region of both shear layers and jets. Jets exiting into both moving and quiescent streams were investigated. Attention was centered on two turbulence models: (1) k epsilon two and (2) k omega prime. The same numerical flow field code was utilized with both turbulence models thus allowing a direct comparison of the turbulence models without fear of difference in the numerics masking the results. Results showed significant errors can be made when utilizing these models for prediction of shear flows of interest. The flow structure for these shear flows is in no way accounted for by the models and hence poor predictions result. It is felt the basic vortex structure will have to be modeled before significant improvement in the modeling will occur. GRA

N81-18089# ARO, Inc., Arnold Air Force Station, Tenn.

AEROTHERMAL TESTS OF THE SPACE SHUTTLE SOLID ROCKET BOOSTER INSTRUMENTATION ISLANDS AT MACH NUMBERS 1.75 TO 10 Final Report, 14 Jan. - 5 May 1980

D. W. Stallings and M. O. King AEDC Jun. 1980 64 p refs Sponsored by AF
(AD-A094278; AEDC-TSR-80-V28) Avail: NTIS HC A04/MF A01 CSCL 22/2

The Space Shuttle Solid Rocket Booster Instrumentation Islands were tested at Mach numbers 1.75, 2.25, 3, and 10 for Reynolds numbers ranging from .600000 to 4740,000 per foot to evaluate potential error sources which might influence the flight test data. The test specimens were instrumented with flight tranducers and with VKF transducers as reference standard. They were mounted on a wedge and tested at wedge angles ranging from 3 to 25 deg. In addition, for the Mach number 10 tests, the VKF infrared system was used to monitor the surface temperature of the test specimens. GRA

N81-18090# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.

PREDICTION OF PAYLOAD INTERNAL PRESSURE Interim Scientific Report

Christopher P. Krebs 4 Sep. 1980 65 p refs
(AF Proj. 7659)
(AD-A094128; AFGL-TR-80-0260; AFGL-IP-290) Avail: NTIS HC A04/MF A01 CSCL 19/7

An analysis of the internal pressure history of sounding rocket payloads as they ascend through the atmosphere was conducted. The analysis was concerned mainly with compressible flow and included the affects of choking. Computer programs were developed that successfully predict the internal pressure from trajectory data. The programs were based on both the theoretical analysis and mathematical models of the flow rates of various venting components used in relieving the payload internal pressure. The mathematical models were developed from empirical data gathered during testing. The payload model can be set up with any combination of relief valves and air filters, and has provisions for including leaks due to doors and seals. Sample program results for several payloads are included along with the program listings. GRA

N81-18091# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

ROCKET RESEARCH AT GEORGIA TECH Interim Technical Report

E. W. Price, W. C. Strahle, B. T. Zinn, J. E. Hubbartt, R. K. Sigman, and B. R. Daniel Nov. 1980 48 p refs
(Contract F49620-78-C-0003; AF Proj. 2308)
(AD-A094483; AFOSR-81-0018TR) Avail: NTIS HC A03/MF A01 CSCL 21/8

Task 1: During the reporting period, the impedance tube setup was utilized in the determination of the admittances ot two aluminized solid propellants. Both the pressure coupled response and the gas phase losses have been determined over the frequency range of 400-1200 Hertz. In a separate study, the feasibility of utilizing either quartz or piezoceramic crystals in the direct measurement of the mass loss of burning solid propellants has been investigated. Finally studies aimed at the adaptation of the impedance tube setup for the measurement of the simulating heating values for practical propellants, have been started. Task 2: Studies were continued on burning in and around the near wake of an axisymmetric model at Mach 3. Burning tests with radiant and axial injection of pure hydrogen have been completed. Burning tests with axial injection of diluted hydrogen, velocity coupled response of burning solid propellant has been initiated. Task 3: Further studies were made of aluminum accumulation and agglomeration on the propellant burning surface and droplet combustion in the gas flow from the surface. Modification of the aluminum powder to control agglomeretion were evaluated by propellant combustion studies and found to be highly effective. Task 4: Experimental and analytical studies were continued on the subject of turbulence-induced pressure flucuations in a rocket-like cavity. An advanced theory has provided closure between theory and experiment on one experimental facility. A fuel rocket motor simulator was built and preliminary results were attained to show the separation between propagational sound and local hydrodynamic noise. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N81-18092# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

KINETIC STUDY OF RADICAL-AROMATIC HYDROCARBON REACTIONS Annual Progress Report, May 1979 - 30 Apr. 1980

A. R. Ravishankara and F. P. Tully 30 Apr. 1980 49 p refs
(Contract DE-AS05-78ER-06030)
(DOE/ER-06030/2; APR-2) Avail: NTIS HC A03/MF A01

A slow flow high temprature flash photolysis resonance fluorescence apparatus which utilizes an all quartz reactor has

been constructed. This apparatus has been used to measure absolute rate constants as a function of temperature and pressure for the reactions of OH radicals with the following prototype aromatic hydrocarbons; C6H6, C6D6, C6H5CH3, and C6D5CD3, in the temperature range of 213 to 1046(0) K. Details of the kinetic investigations are described in this report. At present, the nonexponential OH decays that were obtained in the temperature range of 325 to 425 K are being analyzed to extract both thermodynaic and kinetic information on the OH-Aromatic adduct. Concurrently attempts are being made to assign branching ratios for various reactive channels as a function of temperature using the measured kinetic isotope effects. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N81-18093 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE ACCELERATED CHARACTERIZATION OF VISCOELASTIC COMPOSITE MATERIALS Ph.D. Thesis
William Irving Griffith 1980 166 p
Avail: Univ. Microfilms Order No. 8101884

A brief review of necessary fundamentals relative to composite materials and viscoelasticity is provided. Subsequently the accelerated characterization techniques of time temperature superposition and time temperature stress superposition are treated in detail. An experimental procedure for applying the latter to composites is given along with results obtained on a particular T300/934 graphite/epoxy. The accelerated characterization predictions are found in good agreement with actual long term tests. A postcuring phenomenon is discussed that necessitates thermal conditioning of the specimen prior to testing. A closely related phenomenon of physical aging is described. The effect of each on the glass transition temperature and strength is discussed. Creep rupture results are provided for a variety of geometries and temperatures for T300/934 graphite/epoxy. The results are found to compare resonably with a modified kinetic rate theory. Dissert. Abstr.

N81-18094# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
AN EXPERIMENTAL STUDY OF THERMAL RESISTANCE VALUES (R-VALUES) OF LOW-DENSITY MINERAL-FIBER BUILDING INSULATION BATTS COMMERCIALLY AVAILABLE IN 1977
R. P. Tye (Dynatech R/D Co.), A. O. Desjarlais (Dynatech R/D Co.), D. W. Yarbrough, and D. L. McElroy Apr. 1980 119 p
(Contract W-7405-eng-26)
(ORNL/TM-7266) Avail: NTIS HC A06/MF A01

Full thickness thermal performance data were obtained and other properties of mineral fiber building insulations were assessed. The physical property measurements discussed provide a measure of the range of values for density, thickness, and R-value based on a sampling of low density mineral fiber building insulation batts purchased in the marketplace in 1977. The experimental data were used to establish mean R-values at nominal (label) thickness of R-11 and R-19 fiberglass batts and R-11 rock wool batts. The guarded hot plate apparatus used to obtain full thickness thermal performance data was estimated to be accurate to + or - 3% by a determinate error analysis and from measurements on specimens studied by others. This apparatus was also used to measure the apparent thermal conductivity of sliced batt materials in order to compare the two methods. The results obtained by using sliced materials indicated mean nominal thickness R-values consistent with the manufacturers' label value. The full thickness tests showed mean nominal thickness R-values below (but within 10% of) the manufacturers' label value. The mean R-values by approximately 0.9 R-units for R-11 fiberglass insulations and by approximately 1.2 R-units for R-19 fiberglass insulations both of which exceed the apparatus error estimate. A.R.H.

N81-18095*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DEVELOPMENT OF AN IMPROVED TOUGHNESS HYPERPURE SILICA REFLECTIVE HEAT SHIELD Contractor Report, 3 Jul. 1978 - 3 Jul. 1979
E. L. Rusert, T. L. Hackett, and D. N. Drennan Aug. 1979 93 p refs
(Contract NAS2-10003)
(NASA-CR-152297) Avail: NTIS HC A05/MF A01 CSCL 11D

High purity three dimensionally woven silica-silica materials were evaluated for use as a tough reflective heat shield for planetary entry probes. A special weave design was selected to minimize light piping effects through the heat shield thickness. Various weave spacings were evaluated for densification efficiency with an 0.7 micron particle size high purity silica. Spectral hemispherical reflectance was measured from 0.2 to 2.5 microns at room temperature. Reflectance increases due to densitication and purity of material were measured. Reflectance of 3D hyperpure silica was higher than 3D astroquartz silica for all wavelengths. Mechanical properties were measured in beam flexure and beam shear tests. Results indicated strengths lower than reported for slip cast fused silica. Low strengths were attributed to low densities achieved through vacuum impregantion. S.F.

N81-18096*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RISK TO THE PUBLIC FROM CARBON FIBERS RELEASED IN CIVIL AIRCRAFT ACCIDENTS
1980 71 p refs
(NASA-SP-448) Avail: NTIS HC A04/MF A01 CSCL 11D

Because carbon fibers are strong, stiff, and lightweight, they are attractive for use in composite structures. Because they also have high electrical conductivity, free carbon fibers settling on electrical conductors can cause malfunctions. If released from the composite by burning, the fibers may become a hazard to exposed electrical and electronic equipment. As part of a Federal study of the potential hazard associated with the use of carbon fibers, NASA assessed the public risk associated with crash fire accidents of civil aircraft. The NASA study projected a dramatic increase in the use of carbon composites in civil aircraft and developed technical data to support the risk assessment. Personal injury was found to be extremely unlikely. In 1993, the year chosen as a focus for the study, the expected annual cost of damage caused by released carbon fibers is only $1000. Even the worst-case carbon fiber incident simulated (costing $178,000 once in 34,000 years) was relatively low-cost compared with the usual air transport accident cost. On the basis of these observations, the NASA study concluded that exploitation of composites should continue, that additional protection of avionics is unnecessary, and that development of alternate materials specifically to overcome this problem is not justified. Author

N81-18097*# HITCO, Gardena, Calif. Defense Products Div.
DEVELOPMENT OF ASSEMBLY TECHNIQUES FOR FIRE RESISTANT AIRCRAFT INTERIOR PANELS Final Report
Samuel C. S. Lee May 1978 67 p refs
(Contract NAS2-9153)
(NASA-CR-152119; HTR-5-78) Avail: NTIS HC A04/MF A01 CSCL 11D

Ten NASA Type A fire resistant aircraft interior panels were fabricated and tested to develop assembly techniques. These techiques were used in the construction of a full scale lavatory test structure for flame propagation testing. The Type A panel is of sandwich construction consisting of Nomex honeycomb filled with quinone dioxime foam, and bismaleimide/glass face sheets bonded to the core with polyimide film adhesive. The materials selected and the assembly techniques developed for the lavatory test structure were designed for obtaining maximum fire containment with minimum smoke and toxic emission. Author

N81-18098*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CHARACTERIZATION OF DELAMINATION ONSET AND GROWTH IN A COMPOSITE LAMINATE
T. Kevin OBrien Jan. 1981 62 p refs Presented at the ASTM Symp. on Damage in Composite Mater.: Basic Mech., Accumulation, Tolerance, and Characterization, Bal Harbour, Fla., 10-14 Nov. 1980
(NASA-TM-81940) Avail: NTIS HC A04/MF A01 CSCL 11D

The onset and growth of delaminations in unnotched (+ or - 30/+ or - 30/90/90 bar) sub S graphite epoxy laminates is described quantitatively. These laminates, designed to delaminate at the edges under tensile loads, were tested and analyzed. Delamination growth and stiffness loss were monitored nondestructively. Laminate stiffness decreased linearly with delamination size. The strain energy release rate, G, associated with delamination growth, was calculated from two analyses. A critical G for delamination onset was determined, and then was used to predict the onset of delaminations in (+45 sub n/-45 sub n/o sub n/90 sub n) sub s (n= 1,2,3) laminates. A delamination resistance curve (R curve) was developed to characterize the observed stable delamination growth under quasi static loading. A power law correlation between G and delamination growth rates in fatigue was established. Author

N81-18099# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NONDESTRUCTIVE EVALUATION OF DAMAGE IN METAL MATRIX COMPOSITES Final Report
David A. Ulman, Edmund G. Henneke, John C. Duke, Kenneth L. Reifsnider, and Wayne W. Stinchcomb 1 Jun. 1980 161 p refs
(Contract N00014-78-C-0153; ARPA Order 3388)
(AD-A094514) Avail: NTIS HC A08/MF A01 CSCL 11/4

The major purpose of this work was to develop a technical base for the application of nondestructive evaluation methods to metal matrix composites. Objectives were established: (1) to obtain base line data on nondestructive evaluation methods applied to metal matrix, fiber-reinforced composite coupon specimens with controlled, fabricated flaws; (2) to investigate ways of modifying NDE methods for application to specimens having geometries other than the flat coupon specimens; and (3) to apply appropriate NDE methods to other specimens that would be mechanically tested elsewhere. An evaluation of nondestructive techniques for determining damage in Al/FP composite materials was performed and is presented here. The nondestructive techniques examined include X-ray radiography, ultrasonic C-scan, ultrasonic attenuation, video-thermography, replication, stiffness change, eddy current and acoustic emission. To control the location of damage development notches were manufactured into several specimens. After thorough initial nondestructive characterization, the specimens were fatigued in three point bending to initiate damage. The damage in the specimens was monitored at the intermediate fatigue stages by nondestructive evaluation techniques to determine which techniques best characterize the material condition. Replication, radiography and C-scan were determined to be the best NDE techniques used for evaluation of the FP/Al composites. GRA

N81-18100# Bendix Corp., Kansas City, Mo.
PARYLENE COATING OF SYNTACTIC COMPOSITES
A. H. Schloman Nov. 1980 36 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2517) Avail: NTIS HC A03/MF A01

A manufacturing process developed for parylene coating syntactic parts is addressed. Thin edges were strengthened, which minimizes breakage during the manufacturing process and subsequent assembly; part and surface toughness was improved; the coefficient of friction during assembly was reduced; and the bonding of the pads, shoehorn, and strength of the syntactic composite as a result of the coating are discussed, and coated parts and deposited films produced by laboratory and production coaters are compared. DOE

N81-18101# Delaware Univ., Newark. Dept. of Chemistry.
***MOLECULAR DYNAMICS OF NITRAMINES AND HIGH ENERGY COMPOSITE MATERIALS* Final Report, 1 Oct. 1976 - 30 Sep. 1980**
Thomas B. Brill Nov. 1980 25 p refs
(Grant AF-AFOSR-3055-76; AF Proj. 2308)
(AD-A094414; AFOSR-81-0029TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

A study of the molecular dynamics of the solid phase of HMX and RDX was undertaken to learn the effects of thermal and pressure stress on these nitramines. Raman, nuclear quadrupole resonance, and nuclear magnetic resonance spectroscopy, mass spectrometry, X-ray methods and computer graphics were or are being employed. A complete analysis of the four polymorphs of HMX as a function of temperature and pressure by using Raman spectroscopy was made. A pressure-temperature phase diagram of the beta-to-delta-HMX solid phase transformation was developed. Computer graphics were employed to examine the inter and intramolecular interactions that might play a role in thermal degradation of HMX. The positioning of atoms in the lattice is favorable for HONO, CH2O and N2O formation from the solid materials. Mass spectrometry is being used to examine in detail the possible differences in the product distribution during pyrolysis of the polymorphs of HMX. Nuclear resonance spectroscopy employing both the magnetic and quadrupole moments of nuclei in HMX molecule is being conducted to discover the specific molecular motions as HMX is heated from 77K through the beta-to-delta phase transformation. The results reveal a considerable increase in molecular motion in the lattice as it heats. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N81-18102 California Univ., Los Angeles.
MASS TRANSFER OF ELECTROLYTES IN MEMBRANES Ph.D. Thesis
Peter Nicholas Pintauro 1980 218 p
Avail: Univ. Microfilms Order No. 8102869

A mathematical model which describes solvent and solute transport across neutral or ion exchange membranes was developed. The model, which was based on concentrated electrolyte theory and the Stefan-Maxwell transport equations, predicts the salt and solvent fluxes through the membrane along with the concentration, pressure and electrical potential profiles in the membrane. For a binary salt solvent membrane system, the model contained six transport and two equilibrium parameters. These parameters were experimentally determined for a Nafion perfluorosulfonic acid cation exchange membrane in 1.0, 2.0, 3.0, 4.0 and 5.0 M NaCl solutions at 25 C. The model with the experimentally determined parameters was able to predict the membrane conductivity as a function of concentration, the concentration decay curve from a 1.0-3.0 M NaCl dialysis experiment and the volumeric flow rate through the membrane as a function of time from a 3.6-4.8 M NaCl dialysis experiment. A model for determining the equilibrium membrane salt content and a correlation for the membrane diffusion coefficient of sodium ions were developed. Dissert. Abstr.

N81-18103 State Univ. of New York at Buffalo, Amherst.
***ABSOLUTE RATE CONSTANTS FOR THE FREE RADICAL* POLYMERIZATION OF ETHYLENE IN THE SUPERCRITICAL PHASE Ph.D. Thesis**
Tsutomu Takahashi 1980 220 p
Avail: Univ. Microfilms Order No. 8104244

An apparatus was designed and constructed which allowed the determination of the absolute rate constants for chain propagation K sub p, and for chain termination K sub t in the free radical polymerization of ethylene at about 1900 kg/sq cm and at 130 C. This is the first reported measurement of these kinetic constants under supercritical conditions similar to those existing in the commercial high pressure polymerization process for low density polyethylene. The experiment was based on the rotating sector method to determine lifetimes of chain carriers combined with the inhibition period method for initiation rates. Essential to the success of the project was the construction of a quasi-isothermal leak free batch reactor, in which polymerization rates could be followed by monitoring the pressure change and one in which the entire reactor contents could be illuminated through a window with a large unsupported area that could tolerate the reaction pressure. Dissert. Abstr.

N81-18104 Utah State Univ., Logan.
AN EVALUATION OF POLYCYCLIC AROMATIC HYDROCARBONS FROM PROCESSED OIL SHALES Ph.D. Thesis
David Lawrence Maase 1980 202 p
Avail: Univ. Microfilms Order No. 8104112

The characterization of organic residue associated with processed oil shale was studied in order to aid in the evaluation of the potential impact of oil shale development. A forecast of oil shale development in the White River Basin was projected and hydrological and geological parameters pertinent to estimations of polycyclic aromatic hydrocarbon (PAH) flux were presented. Organic residues from processed oil shales were characterized with specific attention to PAH. Processed oil shale samples were extracted by using organic solvents in a soxhlet apparatus and by mixing shale samples with water. Reported organic chemistry isolation and identification regimes (applicable to gas, liquid and solid samples) are summarized in a tabular format. More than 100 organic compounds from processed oil shales were identified by gas chromatography coupled with mass spectrometry. Dissert. Abstr.

N81-18105 Cornell Univ., Ithaca, N. Y.
DIRECT DIGITIZATION FOR QUANTIFICATION IN ION MICROSCOPY Ph.D. Thesis
Bruce Kenneth Furman 1980 140 p
Avail: Univ. Microfilms Order No. 8102954

A system for the quantification of secondary ion mass spectrometric images produced by an ion microscope is presented. The Microscopic Image Digital Acquisition System (MIDAS) developed in this laboratory coupling a CAMECA IMS-300 ion microscope, a low light level TV camera, a video color graphics system and digital image processing techniques, is described. Ion images detected by the television camera are converted in real time into matrices of point intensities, maintaining the spatial resolution of the original image. These image matrices may then be converted to ion intensity space, or by the use of standards, to concentration. The use of ion implantation to fabricate image standards is presented as an evaluation of MIDAS. Results obtained with the MIDAS system are less that 20% relative error to results obtained by the conventional photomultiplier detection system. Analyses performed on a large number of different silver halide materials including: evaporated layers, sheet crystals, large single crystals, and emulsion grains both with and without gelatin present. Dissert. Abstr.

N81-18106 North Carolina Univ. at Chapel Hill.
CHEMICALLY MODIFIED ELECTRODES AND REDUCTION OF WATER TO HYDROGEN VIA BIPYRIDINE COMPLEXES OF RUTHENIUM Ph.D. Thesis
Hector Daniel Abruna 1980 283 p
Avail: Univ. Microfilms Order No. 8104358

By the sequential deposition of electroactive polymeric films of ruthenium complexes having different formal potentials, 'bilayer' electrodes that exhibited rectifying behavior were prepared. The reaction of reduced polypyridine complexes of ruthenium with aqueous solutions of varying pH was studied. It was found that for complexes which could act as one-electron reductants there were a series of competing reactions: (1) hydrogen evolution: (2) ligand reduction; (3) ligand substitution; (4) solvent (CH3CN) reduction. Hydrogen evolution was only observed in the presence of Pt, which seems to indicate that a catalyst is needed to mediate such a process. The mechanistic value of having a two electron reductant was demonstrated. In this case, quantitative hydrogen evolution (in the presence or absence of Pt) was observed upon the addition of aqueous solutions of pH ranging from 0 to 14 to the doubly reduced complexes. The rate of hydrogen evolution was a strong function of pH, taking place in the time of mixing at low pH, and several minutes at high pH. Dissert. Abstr.

N81-18107 Northwestern Univ., Evanston, Ill.
APPLICATIONS OF RAMAN SCATTERING TO THE STUDY OF THE ELECTRODE/SOLUTION INTERFACE Ph.D. Thesis
Craig Stewart Allen 1980 233 p
Avail: Univ. Microfilms Order No. 8104683

Normal Raman, resonance Raman and a technique of surface enhanced Raman spectroscopy (SERS) were applied to the study of multilayer and adsorbates on several different electrode metals. The SER effect, which to date was observed only for silver, copper and gold surfaces was characterized by huge increases in the Raman scattering cross section for molecules adsorbed on the surface of these metals. For the intensively studied case of pyridine on silver, the enhancement factor was approximately one million and a number quite close to that was found for copper. Not all molecular vibrations are enhanced to the same extent on going from bulk phase to the adsorbed state. Isomeric monocyanopyridines show progressively weaker CN stretching vibrations in the series 4- to 3- to 2- as the orientation of the cyano group with respect to the metal surface was changed from perpendicular to near parallel. Dissert. Abstr.

N81-18108 North Carolina Univ. at Chapel Hill.
KINETIC BEHAVIOR OF OZONE IN AQUEOUS SOLUTION: DECOMPOSITION AND REACTION WITH PHENOL Ph.D. Thesis
Mirat Denizel Gurol 1980 254 p
Avail: Univ. Microfilms Order No. 8104388

Different physical and chemical reactions which take place simultaneously during the course of oxidation of phenol by ozone in an ozone contactor are: (1) mass transfer of ozone from the gas phase into solution; (2) self decomposition of ozone; (3) oxidation of phenol and its oxidation products by ozone and by decomposition products of ozone. The kinetics of these three steps are evaluated and a rate expression which describes the overall rate of phenol removal at various pH values is provided. The hydroxylation pathway for the direct oxidation of phenol through the production of catechol and hydroquinone was found to constitute a minor portion of the total oxidation pathway at pH 3. The rate of phenol removal was observed to increase with increasing solution pH. Dissert. Abstr.

N81-18109 Massachusetts Univ., Amherst.
ELECTRON MICROSCOPY AND X-RAY DIFFRACTION STUDIES OF HIGH MODULUS SOLID STATE EXTRUDED POLYETHYLENE Ph.D. Thesis
Edward Shiel Sherman 1980 198 p
Avail: Univ. Microfilms Order No. 8101395

The structure of high modulus, solid state extruded polyethylene (PE) and conventionally drawn PE were studied by conventional and scanning transmission electron microscopy. Wide and small angle X-ray scattering was used to determine how the morphology and properties change with processing conditions and the role of annealing during the extrusion process. Electron microscopy techniques were developed for examining the structure of these fibrous samples and other semicrystalline polymer morphologies. Dissert. Abstr.

N81-18110 Louisiana State Univ. and A&M Coll., Baton Rouge.
TECHNIQUES OF ATOMIC ABSORPTION: DIRECT DETERMINATION OF CADMIUM IN BIOLOGICAL MATERIALS AND METAL SPECIATION BY DIFFERENTIAL ATOMIZATION Ph.D. Thesis
Susan Deborah Weiss 1980 332 p
Avail: Univ. Microfilms Order No. 8103655

A method was developed for the direct determination of cadmium in biological materials. The method made use of a unique carbon bed atomizer for electrothermal atomic absorption spectroscopy. A sample introduced onto the heated carbon bed was completely decomposed and atomized before being drawn through the lightpath, where atomic absorption was recorded. Use of the carbon bed atomizer efficiently broke down the organic matrix of biological samples, thereby reducing background absorption and eliminating the need for previous ashing steps. The sensitivity of the method was sufficient so that preconcentration of the sample was unnecessary. A technique was developed which used a dual-stage atomizer for atomic absorption spectroscopy to distinguish between different chemical forms of metals. The first stage, consisting of a platinum wire loop, was gradually increased in temperature to vaporize different forms of a metal at their characteristic temperatures. The second stage, which was the carbon bed, was maintained hot to atomize the vaporous metallic species. Dissert. Abstr.

N81-18111 Iowa State Univ. of Science and Technology, Ames.
THE DETERMINATION OF MERCURY AT TRACE LEVELS

BY FLOW-INJECTION ANALYSIS WITH ELECTROCHEMICAL DETECTION *Ph.D. Thesis*
Timothy Rhea Lindstrom 1980 213 p
Avail: Univ. Microfilms Order No. 8103447

Electrochemical investigations were performed with respect to the development of a flow-injection, electroanalytical method for the quantitative determination of Hg(2) in acidic media. The *method utilizes the deposition of Hg(2) at underpotential on a* Au electrode, followed by Differential Pulse Anodic Stripping Voltammetry. The linear dynamic range of calibration for the proposed method is shown to be over three orders of magnitude in concentration of Hg(2). The optimization of the experimental variables of DP ASV, applied within the scheme of flow-injection analysis, is described. Described are the effects of flow rate during the stripping scan; modulation amplitude; rate of potential scan; cycle period of pulses; flow rate during deposition when the injected, sample volume is constant; and the time of deposition. The method is shown to be highly selective for Hg(2) *with the exception of Ag(1) which interferes with the quantitative* determination of Hg(2) when both ions are present at comparable concentrations. Dissert. Abstr.

N81-18112 Houston Univ., Tex.
MODEL STUDIES ON CARBON COMBUSTION *Ph.D. Thesis*
Sankaran Sundaresan 1980 176 p
Avail: Univ. Microfilms Order No. 8103615

Oxygen that diffuses through boundary layer and reacts with carbon at the particle surface to form carbon monoxide is studied. The physico-chemical rate processes that occur in the boundary *layer surrounding the particle, with the intraparticle resistances* lumped at the surface in the form of an effective rate constant for carbon oxidation, are discussed. An examination of the pseudo *steady state problem associated with carbon combustion reveals* three classes of steady state structures. The important parameters which determine the complexity of the steady state structures *are the concentration of oxygen in the gas phase and the type* of environment with which the particle is in radiant interaction. The water vapor present in the gas phase participates in carbon *combustion through the reaction between carbon and H2O, and* the catalytic effort on CO oxidation. For modest quantities of water vapor, the reaction between carbon and H2O may be *neglected with no loss of structure, while the catalytic effect of* H2O on CO oxidation is important. Dissert. Abstr.

N81-18113 Rhode Island Univ., Kingston.
SPECTROSCOPIC AND LIGHT-SCATTERING INVESTIGATION OF ANISOTROPIC LIGANDS AS OPTICAL STRUCTURAL PROBES **Ph.D. Thesis**
Wilmont Frederick Howard, Jr. 1980 191 p
Avail: Univ. Microfilms Order No. 8102326

Molecular optical anisotropies of in-solution species were obtained by monitoring depolarized Rayleigh-scattered light intensities. The effects of polar versus nonpolar solvents were investigated, which led to the first successful use of polar solvents under well defined physical constraints. After ascertaining the *molecular optical anisotropies of selected ligands, a number of* octahedral tin(4) completes were synthesized, as well as five coordinate thallium(3), zinc(2), and tin(4) species. The anisotropies *of these organometallic complexes of known structure were* required to establish the ligand probe theory as simple mathematical relationships link free and bound chelate anisotropies. *Vibrational, electronic, and magnetic spectroscopic analyses were* routinely employed to provide supportive evidence for molecular geometry parameters. Dissert. Abstr.

N81-18114 Purdue Univ., Lafayette, Ind.
FLASH PHOTOLYSIS STUDIES OF THE SEMICONDUCTOR/ELECTROLYTE INTERFACE **Ph.D. Thesis**
Jeffrey Rosenthal 1980 196 p
Avail: Univ. Microfilms Order No. 8102700

The semiconductor/electrolyte interface, as applicable to solar energy conversion, was studied using the technique of flash photolysis with electrochemical monitoring. Two important observations came out of these studies. First, the intermediates or products of a light induced reaction at a semiconductor/electrolyte interface are electrochemically detectable at the semiconductor. This was demonstrated by the detection of a photo-oxidation product shown to exist under continuous *irradiation by cyclic voltammetry. Also detected were the light* induced decomposition products of n-type and p-type semiconductors, at conditions consistent with the literature observations. Second, charge transfer between a semiconductor electrode and a species in solution can be so slow that detection on the time scale of a flash photolysis experiment is not possible.
Dissert. Abstr.

N81-18115 Purdue Univ., Lafayette, Ind.
REFINEMENTS OF MASS SPECTROMETRY/MASS SPECTROMETRY AND APPLICATIONS TO ORGANIC ANALYSIS **Ph.D. Thesis**
Mary Lou Sigsby 1980 226 p
Avail: Univ. Microfilms Order No. 8102708

As a part of the development of mass spectrometry/mass spectrometry (MS/MS) for metastable ion analysis, the addition of collision-induced dissociation (CID) capabilities has permitted *various novel applications of the technique. This work deals with* applications of the CID MS/MS technique; characterizing its usage for analytical questions. The basic experiment involves *kinetic energy analysis of fragments produced upon collisional* excitation of a mass-analyzed ion generated in a chemical ionization source. The applications presented included characterization of fragmentation chemistry, isomer analysis, quantitative direct analysis of mixtures, studies of doubly-charged negative ions, and utilization of dual collision phenomena. Application of CID *MS/MS to direct mixture analysis shows the quantitative* properties of the technique. Analysis of individual isomeric urinary acids without pretreatment of urine samples exemplifies to degree *of mixture complexity directly analyzable with CID MS/MS.*
Dissert. Abstr.

N81-18116 *South Carolina Univ., Columbia.*
OPTIMIZATION AND INTERPRETATION OF CHROMATOGRAPHIC METHODS IN GAS CHROMATOGRAPHY AND ***ANALYTICAL PYROLYSIS*** ***Ph.D. Thesis***
Christopher Allan Jacques 1980 169 p
Avail: Univ. Microfilms Order No. 8102768

The evaluation of a gas liquid chromatographic system by means of response surface methodology is presented. The relationship between the controlled factors (flow rate, temperature, *and stationary phase loading) and the measured responses* (separation and analysis time) in isothermal gas chromatography were examined (1) by performing experiments in a systematic *design that varies the levels of the factors of interest; and (2) by* fitting simple empirical models to the experimental data. Plots of these response surface models were used to evaluate and *optimize the system. Some practical guidelines for the selection* and preparation of packed and glass capillary gas liquid chromatography columns are summarized. The relationships of selectivity and efficiency to column production are discussed.
Dissert. Abstr.

N81-18117 Washington State Univ., Pullman.
THE DETECTION OF TRACE ELEMENT SPECIES IN ***SOLVENT REFINED COAL*** ***Ph.D. Thesis***
Carl Steven Weiss 1980 132 p
Avail: Univ. Microfilms Order No. 8104155

The separation of solvent refined coals 1 and 2 were performed using a nine step solvent gradient separation on a silica support. The solvent refined coal 1 solid was subjected to solvent extraction *with tetrahydrofuran before the separation. The solvent refined* coal 2 was filtered prior to the separation. Each of the fractions generated was subjected to instrumental neutron activation analysis. In addition, two of the more functional fractions from the solvent refined coal 1 silica separation were fractionated *based on molecular weight using gel permeation chromatography.* these fractions were also analysed by instrumental neutron activation analysis. Atomic absorption spectroscopy was used to *determine Ca, Mg, Fe, and Be in some of the fractions generated,* as an element selective detector for the effluent of a gel permeation chromatographic column. Dissert. Abstr.

N81-18118 Utah Univ., Salt Lake City.
CATALYTIC CRACKING OF HYDROTREATED COAL LIQUIDS AND RELATED POLYCYCLIC NAPHTHENES AND NAPHTHENOAROMATICS **Ph.D. Thesis**

Sunder Swaminathan 1980 227 p
Avail: Univ. Microfilms Order No. 8103900

A systematic catalytic cracking investigation of hydrotreated coal derived liquids was conducted and related model compounds found in such liquids were developed. The studies were performed in a flow reactor, using REY type zeolite containing catalysts. The following types of starting feedstocks were employed: (1) polycyclic naphthenes, viz. decalin and perhydrophenanthrene; (2) polycyclic naphthenoaromatics, viz. tetralin, 1,2,3,4,5,6,7,8-octahydroanthracene and 9,10-dihydrophenanthrene; and (3) hydrotreated SRC-2 liquids. Changes in product composition as a function of experimental variables (temperature, space velocity and catalyst type) were investigated and mechanistic aspects of the cracking reactions elucidated. Dissert. Abstr.

N81-18119 *Tennessee Univ., Knoxville.*
THE APPLICATION OF SEPARATION METHODS TO THE ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS BY MATRIX ISOLATION FOURIER TRANSFORM INFRARED SPECTROSCOPY Ph.D. Thesis
Doyle Milton Hembree, Jr. 1980 140 p
Avail: Univ. Microfilms Order No. 8104591

The combined use of separation methods and matrix isolation Fourier transform infrared spectroscopy for the analysis of polycyclic aromatic hydrocarbons was evaluated. A liquid chromatographic method employing an alumina column and a steam distillation/extraction technique were used as preparative scale procedures for separating fractions containing polycyclic aromatic hydrocarbons from synthetic fuel samples. Fractional sublimation was used as a method for achieving a degree of separation in the matrix isolation sample deposition process. Synthetic mixtures were fractionated using this technique. Fractional sublimation was shown to be a useful tool for qualitative analyses of mixtures of polycyclic aromatic hydrocarbons, particularly for identifying the more volatile components in samples containing large numbers of compounds. Capillary column gas chromatography was coupled with matrix isolation Fourier transform infrared spectroscopy and used for both qualitative and quantitative analyses of polycyclic aromatic hydrocarbons in complex mixtures. Dissert. Abstr.

N81-18120 *California Univ., San Diego.*
LASER FLOW DIAGNOSTICS AND PARTICLE SIZING IN FLAMES Ph.D. Thesis
Peter Hsiau-Pen Chang 1980 159 p
Avail: Univ. Microfilms Order No. 8023091

Theoretical curves needed to define log normal particle size distributions from the measured power spectra of scattered laser radiation in diffusion spectroscopy are presented. Procedures for making estimates of the count median diameters and standard deviations in log normal size distributions are defined. Experimental results (as functions of equivalence ratio and downstream distance), obtained on a flat flame burner for fuel rich mixtures of methane with oxygen, were obtained. Size estimates were also made with a conventional light scattering technique on the assumption that particle sizes are defined by the self preserving distribution. Detailed considerations on measurements of particle sizes (or temperatures), using the power spectra of scattered radiation from pulsed lasers are presented. In conclusion, a procedure for simultaneous determinations of mean particle radii and mean vaules of fluctuating velocity components in turbulent flows containing monodisperse particles is described.
Dissert. Abstr.

N81-18121 *Rhode Island Univ., Kingston.*
THE CHARACTERIZATION OF SUPPORTED BIMETALLIC SYSTEMS USING THE INFRARED SPECTRA OF CHEMISORBED SPECIES Ph.D. Thesis
Charles Minard Grill 1980 121 p
Avail: Univ. Microfilms Order No. 8102322

The chemisorption of NO on silica supported Pd was studied using infrared spectroscopy. Two bands were present on supported Pd. The band at 1735/cm was assigned to a linearly bound NO species with little back-bonding. The band at 1645/cm was assigned to an NO molecule, linearly bound to Pd atom of low surface coordination. The interaction of NO and CO over supported Pd was studied. It was found that CO reacts with absorbed NO and vice versa. A simple displacement of one by the other does not occur. The products of the reaction are CO2 and N2O. No isocyanate species were observed. Dissert. Abstr.

N81-18122# *Rockwell International Corp., Thousand Oaks, Calif. Electronics Reseach Center.*
CAPLESS ANNEALING OF ION IMPLANTED GaAs Final Report, 1 Sep. 1978 - 31 Aug. 1980
D. P. Siu and A. A. Immorlica, Jr. Dec. 1980 56 p refs
(Contract F49620-78-C-0111; AF Proj. 2306)
(AD-A094412; ERC41013.3FR; AFOSR-81-0035TR) Avail: NTIS HC A04/MF A01 CSCL 07/4

A capless powder annealing technique (PAT) is described and is shown to enable reproducible annealing of ion implanted GaAs without the need of a protective cap. This method employs finely powdered graphite as the annealing medium with a layer of finely crushed GaAs beneath it proving an As-rich environment which prevents the GaAs substrate from decomposing at typical annealing temperatures of 850 C. Using RF spark-source mass spectrometry, an As concentration in excess of the equilibrium value of As over GaAs at the annealing temperature is found in the post-process powder. The crushed GaAs layer is essential in providing this high As concentration. GRA

N81-18123# *Michigan State Univ., East Lansing. Dept. of Chemistry.*
SOLVENT EFFECTS ON THE KINETICS OF SIMPLE ELECTROCHEMICAL REACTIONS. 1: COMPARISON OF THE BEHAVIOR OF CO(III)/(II) TRISETHYLENEDIAMINE AND AMMINE COUPLES WITH THE PREDICTIONS OF DIELECTRIC CONTINUUM THEORY
Saeed Sahami and Michael J. Weaver 8 Jan. 1981 37 p refs Submitted for publication
(Contract N00014-79-C-0670)
(AD-A094309; TR-5) Avail: NTIS HC A03/MF A01 CSCL 07/4

The electroreduction kinetics of Co(en) 3(3+) (en = ethylenediamine), Co(NH3)6(3-), and Co(NH3)5F(2-) have been investigated at mercury electrodes in aqueous solution and six nonaqueous solvents in order to explore the influence of the solvent upon the electrode kinetics of such simple one-electron outer-sphere reactions where the composition of the reactant's coordination sphere remains fixed. Substantial variations in the experimental rate parameters were observed as the solvent was altered; these reflect the influence of the outer-shell solvent upon the reorganization barrier to electron transfer. A simple phenomenological treatment of solvent effects upon the electrode kinetics of such simple redox reactions is given. It is pointed out that double-layer corrected rate constants kcorr can be evaluated at the same Galvani potential in different solvents with useful accuracy; these quantities can provide particular insight into the chemical influence of the solvent. The utility of separating such solvent effects into intrinsic and thermodynamic contributions is noted. The substantial decreases in kcorr seen when substituting several nonaqueous solvents for water were traced to increases in the outer-shell component of the intrinsic free energy barrier. GRA

N81-18124# Michigan State Univ., East Lansing. Dept. of Chemistry.
ENTROPIC AND ENTHALPIC CONTRIBUTIONS TO THE SOLVENT DEPENDENCE OF THE THERMODYNAMICS OF TRANSITION-METAL REDOX COUPLES. 2: COUPLES CONTAINING AMMINE AND ETHYLENEDIAMINE LIGANDS
Saeed Sahami and Michael J. Weaver 8 Jan. 1981 25 p refs Submitted for publication
(Contract N00014-79-C-0670)
(AD-A094308; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

We have been examining the solvent dependence of the thermodynamics of simple transition-metal redox couples as part of an experimental program exploring the role of the solvent in the kinetics and thermodynamics of outer-sphere electron transfer reactions. One-electron redox couples containing substitutionally inert complexes form especially tractable systems for this purpose since the influence of variations in the outer-shell solvent contributions can be assessed separately from the inner-shell (metal-ligand coordination shell) effects. Our general

approach is to determine the formal potential Ef of each redox couple in a range of solvents having suitably varied chemical and physical properties. In addition, the temperature dependence of Ef is monitored in each solvent using a nonisothermal cell arrangement, yielding values of the reaction entropy of the redox couple equals the difference between the absolute ionic entropies of the reduced and oxidized forms. These measurements yield estimates of the free energy, entropy, and enthalpy of transferring the redox couple from water to other solvents. GRA

N81-18125# Michigan State Univ., East Lansing. Dept. of Chemistry.

ENTROPIC AND ENTHALPIC CONTRIBUTIONS TO THE SOLVENT DEPENDENCE OF THE THERMODYNAMICS OF TRANSITION METAL REDOX COUPLES. 1: COUPLES CONTAINING AROMATIC LIGANDS

Saeed Sahami and Michael J. Weaver 8 Jan. 1981 34 p refs Submitted for publication

(Contract N00014-79-C-0670)

(AD-A094307; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

Variations in the solvent medium are generally expected to yield profound changes in the thermodynamics and kinetics of electron transfer reactions. The origins of the observed solvent effects are frequently manifold, arising from alterations in the chemical nature of the reacting species as well as the reactant-solvent interactions in both the ground reactant and transition states. We have embarked on a systematic study of solvent effects upon the electrode kinetics and thermodynamics of redox couples involving substitutionally inert cations where the oxidized and reduced species are both stable in the solution phase and differ only by one electron. GRA

N81-18126# Rochester Univ., N. Y. Dept. of Chemistry.

CLASSICAL MODEL OF LASER-STIMULATED SURFACE PROCESSES: ENERGY ABSORPTION PROFILES VIA THE LANGEVIN EQUATION

Jui-teng Lin and Thomas P. George Dec. 1980 42 p refs Submitted for publication

(Contracts N00014-80-C-0472; F49620-78-C-0005)

(AD-A094310; TR-9) Avail: NTIS HC A03/MF A01 CSCL 20/5

A classical model system, consisting of a diatomic molecule chemisorbed on a solid surface and subjected to infrared laser radiation, is presented. A set of coupled equations of motion characterized by the many-body effects of the surface atoms is reduced to the Langevin equations of a two-body problem in transformed coordinates. The surface-induced damping factor and frequency red-shift of the pumped mode are introduced by using a Wigner-Weisskopf-type approximation. The asymmetric forms of the power absorption and the quantized cross section due to the nonlinear effects of the anharmonicity are shown. The energy absorption profiles (energy absorbed vs time), which are universal for any ranges of laser intensity (i.e., as the intensity changes the profile remains the same provided the time scale is changed appropriately), are plotted for different sets of the damping factor and the detuning. It is found that much longer time scales (microsecond) are required for low-power excitations than for the high-power cases. The advantages and difficulties of the normal-mode method and the numerical method are discussed, and a new set of coupled equations in the rotating frame are developed. GRA

N81-18127# Wisconsin Univ. - Madison. Dept. of Metallurgical and Mineral Engineering.

SITE-SPECIFIC DENSITIES OF STATES FOR CLEAVED AND SPUTTERED GaAs (110) FROM AUGER LINE SHAPES

G. D. Davis, D. E. Savage, and M. G. Lagally 15 Sep. 1980 9 p refs

(Contract N00014-77-C-0474; NR Proj. 322-072)

(AD-A094282; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07/4

The nature and extent of interfacial chemical reactions are major factors affecting the electronic properties of semiconductor-metal or semiconductor-semiconductor interfaces. There reactions and the resulting chemical phases may depend strongly on the surface structure and the extent and nature of structural defects. A first step to understanding defect-related chemical phase formation and interfaces is to correlate local chemical properties with structural defects. We have made an initial attempt to do this for GaAs (110) by comparing the results of several techniques. We have examined the cleaved and sputtered GaAs (110) surface with X-ray photoemission spectroscopy (XPS), Auger electron spectroscopy (AES) line shape analysis, low-energy electron diffraction (LEED), and scanning electron microscopy (SEM). In the Auger process, because the initial core hole is localized around one atom, the probability of exciting a valence electron in a core-core-valence transition falls off quite rapidly away from the core. Consequently, the charge distribution that is probed by such transitions is site-specific and may differ if the initial core hole is made on the anion or the cation. This is in contrast to a photoemission measurement, where sites widely separated in R may contribute to the photoelectron intensity at a particular value of energy. GRA

N81-18128# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

MEASUREMENT OF CL2 CONCENTRATION IN A XeCl HOLLOW CATHODE DISCHARGE INCLUDING THE EFFECT OF H2 ADDITION M.S. Thesis

Jerry D. Winegarden Dec. 1980 102 p refs

(AD-A094404; AFIT/GEP/PH/80-12) Avail: NTIS HC A06/MF A01 CSCL 07/4

A hollow cathode discharge tube was used to excite a Hcl/Xe/Ne gas mixture of 4%/16%/80%. Total gas pressures of 4 and 6 Torr and discharge currents ranging from 200, 300, 400, and 500 m/A were investigated. A photon counting technique was used in a uv absorption spectroscopy experiment to determine the partial pressure of Cl2 as a function of current and pressure and for monitoring the 308 mn emission of XeCl for these conditions. XeCl emission decreased with time as a result of the introduction of additional chlorine to the system from the discharge tube surface. Both this surface supplied chlorine and that originating from the HCl in the original mix resulted in a substantial concentration of Cl2 being observed. The surface desorption rate increased with current and was dramatically enhanced by the addition of small amounts of H2 to the discharge mix. GRA

N81-18129*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

PHOTOLUMINESCENCE STUDY OF THERMAL CONVERSION IN GALLIUM ARSENIDE M.S. Thesis

John McLemore Anderson Dec. 1980 86 p refs

(AD-A094400; AFIT/GEO/PH/80-1) Avail: NTIS HC A05/MF A01 CSCL 07/4

A photoluminescence study was made of undoped and chromium-doped gallium arsenide annealed in three different atmospheres: argon, hydrogen, and nitrogen. The purpose of this study was to determine the causes of thermal conversion and to examine the effects of different annealing atmospheres on this problem. It was found that conversion can be due to any of the a number of causes, rather than to one common cause. Conversion in the samples studied was associated with carbon impurities in undoped samples and with silicon in doped samples. Although manganese was found to be present in many samples, no clear association of manganese with type conversion was found. It was found that annealing under nitrogen gas was the most effective way of maintaining a semi-insulating surface layer. GRA

N81-18130# Georgetown Univ., Washington, D.C. Dept. of Chemistry.

DOUBLE LAYER STRUCTURE AND ELECTRODE KINETICS Final Report, 15 May 1976 - 30 Sep. 1980

Robert DeLevie 30 Sep. 1980 6 p refs

(Grant AF-AFOSR-3027-76; AF Proj. 2303)

(AD-A094392; AFOSR-81-0023TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The modular systems formalism for the description of the admittance of electrode kinetics was applied to membranes, especially to the cases in which membrane-soluble ions cross the membrane, or where ion transport is facilitated by cation carriers, or proton transport by weak acids. The expressions include the effects of the ionic displacement current, which was studied separately in greater detail. Two manuscripts surveyed double

layer effects on membranes and at electrodes, while an extensive review discussed the mathematical modeling of ion transport through membranes. Some problems were treated which occur in the application of admittance measurements to a fixed or rotating disk electrode. GRA

N81-18131# Harvard Coll. Observatory, Cambridge, Mass.
HIGH RESOLUTION VACUUM ULTRAVIOLET SPECTROSCOPY OF SMALL MOLECULES Final Report, 1 Oct. 1979 - 30 Sep. 1980
W. H. Parkinson, D. E. Freeman, and K. Yoshino 30 Sep. 1980 8 p refs
(Grant AF-AFOSR-0018-80; AF Proj. 2303)
(AD-A094393; AFOSR-81-0024TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

A 6.65 meter vacuum spectrograph operated at a wavelength resolution of 0.0006 nm has been used to study the spectroscopy of rare gas molecules relevant to the development of intense vacuum ultraviolet radiation sources and lasers, and photoabsorption and predissociation processes in molecular nitrogen, which in the 80-100 nm region are important sources of upper atmospheric atomic nitrogen. Absorption spectra of XeHe, XeNe, XeAr, XeKr, KrHe, KrNe, and KrAr have been photographed and interpreted as arising from transitions from bound ground states to bound or free excited electronic states of these van der Waals molecules; bound excited states have been found for XeKr and XeAr. The emission spectrum of diatomic argon in the 100-150 nm region has been found to consist of four band systems all terminating on the ground electronic state; the only discrete band system, that emitted from the lowest excited state, has been analyzed rotationally and characterized spectroscopically as a triplet state for which the long range potential has been estimated. The absorption spectrum of atomic krypton in the 84-124 nm region has been obtained, and excited Rydberg states with principal quantum number as high as 60 have been assigned; the lowest two ionization energies have been accurately determined. High resolution absorption spectra of dipole allowed transition in molecular nitrogen, from the ground state to excited Rydberg and valence states have been rotationally analyzed. Some large anomalies in frequency spacings and relative intensities have been interpreted in terms of strong homogeneous perturbations rather than predissociations. GRA

N81-18132# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN ELECTROPHORETIC IMAGE DISPLAY Quarterly Technical Report, 1 Aug. - 31 Oct. 1980
Richard Liebert, Joseph Lalak, and Karl Wittig Nov. 1980 13 p refs
(Contract MDA903-79-C-0439; DARPA Order 3802)
(AD-A094260; QTR-5) Avail: NTIS HC A02/MF A01 CSCL 09/1

The purpose of this work is to develop a 350 x 600 element X-Y addressed electrophoretic image display (EPID). The ion-beam milling process now routinely removes all of the Mylar from the potential wells without destroying the underlying electrode. A number of devices having the 512 character format were fabricated and tested. Interelectrode shorts were found in these displays, and measures are being taken to determine and eliminate their causes. Several of the devices were fabricated with sputtered In2O3/SnO2 (ITO) grid electrodes, these clearly demonstrated the improved contrast expected by replacing the aluminum grid electrode with an ITO electrode. An evaporation system was set up to deposit In2O3. This process is more reproducible than sputtering and gives more transparent films of higher conductivity. Construction of the driver and the interconnection system is complete. The software for the driver has been written. Debugging of the driver and software awaits the availability of a display substantially free of shorts. GRA

N81-18133# Wisconsin Univ. - Madison. Materials Science Center.
COMPARISON OF SITE-SPECIFIC DENSITIES OF STATES OF Ga AND As IN CLEAVED AND SPUTTERED GaAs (110) BY MEANS OF AUGER LINE SHAPES
G. D. Davis, D. E. Savage, and M. G. Lagally 30 Nov. 1980 28 p refs
(Contract N00014-77-C-0474; NR Proj. 322-072)
(AD-A094244; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

Site-specific densities of states for the Ga and As sites in GaAs (110) are derived from the M(1)M(45)V Auger lines and compared for the cleaved and sputtered surfaces. X-ray photoelectron spectroscopy, scanning electron microscopy, and LEED results for these surfaces are also presented. The results are interpreted in terms of a structure for the sputtered surface that consists of a two-phase mixture of Ga and disordered GaAs. GRA

N81-18134# Indiana Univ. at Bloomington. Dept. of Chemistry.
CORRELATION-BASED APPROACHES TO TIME-RESOLVED FLUORIMETRY Interim Technical Report
G. M. Hieftje and G. R. Haugen 30 Jan. 1981 28 p refs Submitted for pulication
(Contract N00014-76-C-0838; Grant NIH GM-24473; NR Proj. 051-622)
(AD-A094543; TR-35; Rept-43) Avail: NTIS HC A03/MF A01 CSCL 07/4

In the past two years, several new techniques have been introduced for the measurement of nanosecond and subnanosecond fluorescence processing. Because these methods use relatively simple instrumentation and offer exceptional time resolution and accuracy, they compete favorably with more established approaches. In this paper, an introduction to these new methods is provided and their capabilities and limitations assessed. GRA

N81-18135# Virginia Univ., Charlottesville. Dept. of Chemistry.
ELECTRON-RICH CARBORANES: STUDIES OF A STEREOCHEMICALLY NOVEL SYSTEM, (CH3)4 C4B7H9, AND 11 VERTEX ARACHNO CLUSTER Interim Report
David C. Finster and Russell N. Grimes Jan. 1981 48 p refs Submitted for publication
(Contract N00014-75-C-0305; Grant NSF CHE-79-09948)
(AD-A094338; TR-37) Avail: NTIS HC A03/MF A01 CSCL 07/4

The controlled degradation of (CH3)4C4B8H (1) in 95% ethanol in air gives (CH3)4C4B7H9 (2). Electrophilic bromination of 2 produces 11-Br-(CH3)4C4B7H8 (3), which is shown in an X-ray diffraction study to have an open face; compounds 2 and 3 can be described as 11-vertex arachno cages. Deprotonation of 2 with NaH in THF generates the monoanion (CH3)4C4B7H8(-) (4) from which the CH proton on the bridging group has been removed. Protonation of 4 gives a new isomer of (CH3)4C4B7H9 (5), whose 11B and 1H FT NMR spectra indicate a substantially different cage geometry from that of 2. The molecular structures of 2-5 and pathways for their interconversion are discussed inlight of NMR, IR, mass spectroscopic, and X-ray evidence. Crystal data for 3: BrC8B7H20; mol wt 271.84, space group P 1-bar, Z = 2; a = 7.764(3), b = 8.352(5), c = 12.317(6)A; alpha = 94.53(5), beta = 95.41(5), gamma = 120.51(5) deg; V = 678 A-cubed; R = 0.057 for 1404 independent reflections having (f sub o) - squared = 3 sigma (F sub o) squared. GRA

N81-18136# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A THEORETICAL AND EXPERIMENTAL STUDY ON THE APPLICATION OF STIMULATED RAMAN SPECTROSCOPY M.S. Thesis
David Charles Slater Dec. 1980 142 p refs
(AD-A094418; AFIT/GEP/PH/80-9) Avail: NTIS HC A07/MF A01 CSCL 20/6

An analysis of the stimulated Raman scattering process has been carried out for three variational techniques of stimulated Raman spectroscopy (SRS) using low power CW lasers and synchronous detection techniques. The three variational techniques of SRS examined are direct SRS, Raman-Induced Kerr Effect (RIKES) and Optically Heterodyned RIKES (OHD RIKES). In this analysis the Raman scattered signals for all three variational techniques were derived using Maxwell's equations for both amplitude and phase modulation techniques. The noise contributions for each technique were also examined. It was found that the main source of noise for each technique was due to probe laser intensity fluctuations. GRA

N81-18137*# Naval Research Lab., Washington, D. C.
A COMPUTATIONAL STUDY OF THE CHEMICAL KINETICS OF HYDROGEN COMBUSTION
T. L. Burks and E. S. Oran 28 Jan. 1981 59 p refs Sponsored by NASA
(NASA-CR-163978; AD-A094348; NRL-MR-4446) Avail: NTIS HC A04/MF A01 CSCL 21/2

A set of elementary reactions and their corresponding rate coefficients has been assembled to describe the homogeneous H2-O2 reaction system over the temperature range 300-3000 K. The reaction mechanism was drawn together assuming that H2-O2 reactive mixtures could be adequately described in terms of self-consistent, thermal distributions of electronically neutral, ground-state reactants, intermediates and products. The resulting time-dependent ordinary differential equations describing the system were integrated assuming various initial pressures, temperatures and initial concentrations of reactants and diluents. The computed results have been compared with experimentally observed induction times, second explosion limits, the rate of reaction above the second explosion limit and the temporal behavior of reaction species. The good agreement between the computational and experimental results attests to the accuracy of the assembled mechanism in its description of the homogeneous reaction system and supports the validity of the set of associated rate coefficients for the elementary reactions of the mechanism over a broad range of reaction conditions. GRA

N81-18138# Indiana Univ. at Bloomington. Dept. of Chemistry.
CORRELATION METHODS IN THE CHEMISTRY LABORATORY Interim Technical Report
Gary M. Hieftje and Gary Horlick 30 Jan. 1981 28 p refs (Contract N00014-76-C-0838)
(AD-A094384; TR-36) Avail: NTIS HC A03/MF A01 CSCL 07/1

The basic operations inherent in the correlation process were reviewed and the range of application of correlation methods examined. Specific examples of how correlation could be used in the chemical laboratory were provided, and references were cited where additional information on correlation could be found. GRA

N81-18139*# San Jose State Coll., Calif.
DYNAMIC, HOT SURFACE IGNITION OF AIRCRAFT FUELS AND HYDRAULIC FLUIDS Final Report, Jan. 1977 - Dec. 1979
Donald J. Myronuk Oct. 1980 47 p refs
(Grants NsG-2165; NsG-2219; AFOSR MIPR FY 1455-77; AF Proj. 3048)
(NASA-CR-163979; AD-A094382; AFAPL-TR-79-2095) Avail: NTIS HC A03/MF A01 CSCL 21/4

The dynamic surface ignition characteristics of aircraft fuels and hydraulic fluids were investigated on heated stainless steel and titanium surfaces. Local air flow (0.8 to 50 meters per second) (2.4 to 152.4 ft/sec) effects were measured. aircraft fuels evaluated on titanium surfaces ignited (25 to 75 C) (77 to 167 F) lower (500 to 600 C) (932 to 1112 F) than values required to ignite the fuels on a heated stainless steel surface. Higher local surface air speeds necessitated higher surface temperatures for ignition of an applied fluid. The same trends were noted for hydraulic fluids sprayed on the heated surfaces. GRA

N81-18140# Rochester Univ., N. Y. Dept. of Chemistry.
LASER-STIMULATED SURFACE PROCESSES AND HETEROGENEOUS CATALYSIS Ph.D. Thesis. Interim Technical Report
Jui-Teng Lin Nov. 1980 81 p refs
(Contract N00014-80-C-0472; NR Proj. 056-749)
(AD-A094337; TR-8) Avail: NTIS HC A05/MF A01 CSCL 07/5

A theoretical study of laser-stimulated surface processes (LSSP), motivated by potentialities in the areas of chemical industrial, material science and academic research, is presented. The possibility of the new phenomena of laser-controlled surface processes (migration, recombination, desorption and heterogeneous rate processes) is demonstrated within the framework of model systems which create a theoretical foundation for an understanding of the quantitative and semi-quantitative aspects of LSSP, and provide possible mechanisms and suggest relevant measurements of LSSP with applications to laser-catalyzed rate processes. For a heterogeneous system of LSSP, the major features and the dynamical behavior are studied by both classical and quantum models, where each model provides one or more mechanism of the processes. They include: microscopic model Hamiltonians (in the Heisenberg-Markovian picture) of multiphoton-multiphonon processes; quantum dynamical model (in the Schrodinger picture) of the selective vs nonselective nature of LSSP; Pauli master equations in photon-energy space for the energy distributions and associated desorption probabilities of the adspecies; phenomenological classical models for the average power absorption of the system, where the many-body effects of the surface atoms are replaced by the damping factor and the frequency-shift; the generalized Langevin theory for the dynamical behavior of LSSP; coupled Newton's equations of a model CO/Ni adspecies/surface system for the numerical simulation of the atom amplitudes and the energies stored in the bonds; and semiclassical model for the laser-selective nature via the multiphonon coupling strength and the internal resonant condition. GRA

N81-18141# Michigan State Univ., East Lansing. Dept. of Chemistry.
CORRELATION OF ELECTRODE KINETICS WITH SURFACE STRUCTURE Final Report, Oct. 1977 - Sep. 1980
Michael J. Weaver Sep. 1980 24 p refs
(Grant AF-AFOSR-3408-77; AF Proj. 2303)
(AD-A094516; AFOSR-81-0014TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

The overall objective of this research is to develop an understanding of the relationships between the kinetics and mechanisms of some simple heterogeneous electron-transfer reactions and the molecular structure of the reactant and the electrode-solution interface. Emphasis is being placed on studies of transition-metal redox couples involving substitutionally inert complexes in aqueous media at a number of solid metals as well as at mercury electrodes. These reactions provide excellent model systems for studying structural effects in electron transfer, since they are mechanistically simple and either inner or outer sphere reaction mechanisms can be induced, depending on the ability of the coordinated ligands to bind to the electrode surface. Problems that were addressed included: (1) the effects of varying the nature of the metal surface upon the rates of inner and outer sphere reactions; (2) the influence of ionic specific adsorption upon the reactivities of outer sphere pathways; (3) determination of the influence of reactant specific adsorption to the reorganization energy barrier for electron transfer; and (4) elucidation of the role of reactant-solvent interactions in redox kinetics and thermodynamics. GRA

N81-18142# Factory Mutual Engineering, Norwood, Mass.
CATEGORIZATION OF CABLE FLAMMABILITY DETECTION OF SMOLDERING AND FLAMING CABLE FIRES Interim Report
M. A. Delichatsios Nov. 1980 81 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 1165-1)
(EPRI-NP-1630) Avail: NTIS HC A05/MF A01

The purpose of this program for developing detection requirements in cable fires was to investigate the effects of forced ventilation and temperature stratification on the detection of flaming and smoldering fires, and to specify spacing requirements of smoke detectors for flaming cable fires in rooms with flat and beamed ceilings, and in corridors. A simple corridor geometry, common in nuclear reactors, was constructed to study forced ventilation and temperature stratification effects on the detection of smoldering and flaming fires. Criteria for specifying spacing requirements for flaming cable fires were developed for rooms with extensive flat ceilings based on a methodology previously developed for Factory Mutual Research Corporation, and for rooms with beamed ceilings and for corridors based on experimental results in the corridor tests and on a new analysis developed for the present program. GRA

N81-18143# Oak Ridge National Lab., Tenn.
MATHEMATICAL MODEL FOR MULTICOMPONENT

SEPARATIONS ON THE CONTINUOUS ANNULAR CHROMATOGRAPH
Robert L. Bratzler Dec. 1980 83 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6706) Avail: NTIS HC A05/MF A01

A model for multicomponent separations on ion exchange columns was adapted for use in studying the performance of the continuous annular chromatograph. The model accurately predicts solute peak positions in the column effluent and qualitatively predicts trends in solute effluent resolution as a function of increasing bandwidth of the solute feed pulse. The major virtues of the model are its simplicity in terms of the calculations involved and the fact that it incorporates the nonlinear solute resin binding isotherms common in many ion exchange separations. Because dispersion effects are not accounted for in the model, discrepancies exist between the shapes of the effluent peaks predicted by the model and those determined experimentally. DOE

N81-18144# Los Alamos Scientific Lab., N. Mex.
COMPUTATIONALLY EFFICIENT EXPRESSION FOR THE ZERO-TEMPERATURE ISOTHERM IN EQUATIONS OF STATE
B. I. Bennett Dec. 1980 20 p refs
(Contract W-7405-eng-36)
(LA-8616-MS) Avail: NTIS HC A02/MF A01

A variation on the Barnes' modified Morse potential is given with two methods for determining empirical parameters. The expression does not require the evaluation of a numerical integral to obtain the internal energy of the solid. Hugoniots computed using these two methods are compared with experimental data. DOE

N81-18145# Sandia Labs., Livermore, Calif.
FUNDAMENTAL COMBUSTION AND DIAGNOSTICS RESEARCH AT SANDIA
D. L. Hartley and M. A. Gusinow Dec. 1980 38 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-8246) Avail: NTIS HC A03/MF A01

The combustion research emphasizes basic research into fundamental problems associated with combustion. The program addresses: (1) detailed chemistry of combustion, (2) fundamental processes associated with laminar and turbulent flames, (3) development of research techniques specifically applicable to combustion environments, and (4) operation of the user oriented Combustion Research Facility. The first section of this report contains activities in Combustion Research, the second section contains activities in Molecular Physics and Spectroscopy, and the third section contains activities in Diagnostics Research. DOE

N81-18146# Battelle Pacific Northwest Labs., Richland, Wash.
STUDY OF COAL STRUCTURE USING SECONDARY ION MASS SPECTROMETRY
G. L. Tingey, J. M. Lytls, D. R. Baer, and M. T. Thomas Dec. 1980 26 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3650) Avail: NTIS HC A03/MF A01

Secondary-ion Mass Spectrometry (SIMS) is examined as a tool for studying the chemical structure of coal. SIMS has potential for analysis of coal because of the following characteristics: sensitivity to chemical structure; high sensitivity to all masses; application to solids; excellent depth resolution; and reasonable spatial resolution. SIMS spectra of solid coals show differences with respect to coal rank, the spectra of high rank coal being similar to that of graphite, and the spectra of low rank coal being similar to that of wood. Some functional group analysis is also possible using SIMS. Low rank coals show a larger peak at 15 amu indicating more methyl groups than found in the higher rank coals. Fragments with two and three carbon atoms have also been examined; much larger fragments are undoubtedly present but were not evaluated in this study. DOE

N81-18147# Texas A&M Univ., College Station. Dept. of Chemical Engineering.
CATALYTIC CONVERSION OF OXYGENATED COMPOUNDS TO LOW MOLECULAR WEIGHT OLEFINS Progress Report, 1 Mar. - 31 Aug. 1980
R. G. Anthony 30 Sep. 1980 12 p
(Contracts DE-AC02-78PC-0417; EW-78-S-02-4717)
(COO-4717-5) Avail: NTIS HC A02/MF A01

A possible route for producing low molecular weight olefins was formulated. The reaction apparatus suitable for reaction pressure of 500 to 1000 psig was constructed. A preliminary trial run was performed for the reaction of synthesis gas over an intimate mixture of methanol synthesis catalyst and zeolon-500 (mixture of chabasite and erionite). The reaction temperature, pressure and space velocity were 400(0)C, 800 psig, and 6000/hr (STP), respectively. The total carbon monoxide conversions were 15 to 24%. The major products were carbon dioxide and paraffins of C1 to C4. Deactivation of the catalyst occurred after 10 hours. The X-ray diffraction patterns of the catalyst shows that crystal structure changed during the reaction, and the catalyst exhibited low crystallinity compared to synthetic erionite. DOE

N81-18148# Utah Univ., Salt Lake City.
FOURIER TRANSFORM PHOTOACOUSTIC KINETIC SPECTROSCOPY OF SOLID SURFACES Annual Progress Report, 1 Apr. - 10 Dec. 1980
E. M. Eyring Dec. 1980 12 p refs
(Contract DE-AC02-79ER-10377)
(DOE/ER-10377/2) Avail: NTIS HC A02/MF A01

Application of photoacoustic spectroscopy (PAS) to a zirconium phosphate inorganic system is reported as well as the use of visible synchrotron radiation in quantitative high frequency PAS and a theoretical modeling of such experiments. A Nicole FTIR spectrometer is being used to perform mid-infrared PA spectroscopy on carbon samples with a view to determining the best means of rationing out variations with wavelength in infrared source intensity. DOE

N81-18149# Michigan Univ., Ann Arbor. Gas Dynamics Labs.
INITIATION OF DETONATION IN UNCONFINED NATURAL GAS-AIR CLOUDS Final Report
J. A. Nicholls and M. Sichel May 1980 42 p refs
(GSRI Proj. 5014-363-0132)
(PB81-113292; UMICH-320639-F; GRI-79/0068) Avail: NTIS HC A03/MF A01 CSCL 21D

The possibility that an unconfined combustible cloud arising from the release of liquefied natural gas could detonate is evaluated. A sector of a cylindrical cloud was modeled by a special shock tube. Blast waves of variable strength were transmitted into the combustible mixture. Since methane air couldn't be detonated, the critical initiation energy requirements for various stoichiometric methane oxygen nitrogen mixtures were determined and then extrapolated to determine the value for methane air. Extremely high values were indicated. The analysis allowed planar, cylindrical, and spherical geometries to be considered. GRA

N81-18150# Naval Surface Weapons Center, White Oak, Md.
TRANSPARENT TUBE STUDIES OF BURNING TO DETONATION TRANSITION IN GRANULAR EXPLOSIVES. 1: PRELIMINARY FRAMING CAMERA STUDIES Progress Report, Sep. 1976 - Dec. 1977
Harold W. Sandusky and Richard R. Bernecker 27 Oct. 1980 119 p refs
(AD-A094423; NSWC/TR-79-79) Avail: NTIS HC A06/MF A01 CSCL 19/1

Burning of relatively high porosity granular explosive charges, confined in transparent plastic tubes, was photographed with a framing camera. Observed luminous fronts corresponded to the displacement of the charge from the ignitor by the mild gas pressure of the ignitor, an increased rate of displacement once the explosive itself ignited, and the propagation of flame down the charge. Luminous flame velocities were similar to convective ignition front velocities measured by ionization probes in previous steel tube studies. In charges of 94/6 RDX/wax, luminous front velocities were similar to the high order compressive burning which followed the convective ignition front in steel tube studies. Although all these explosives tested previously in steel tube studies achieved a transition from deflagration to detonation, only coarse tetryl (470 micrometers) transited to detonation in the low confinement of the plastic tube. GRA

N81-18151 City Univ. of New York, N. Y.
THE STUDY OF COMPLEXES OF HETEROCYCLIC BASES BY UV PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Allen William Gin 1980 146 p
Avail: Univ. Microfilms Order No. 8103928

The UV photoelectron spectra of Cr(CO)5.L, BH3.L (where L = 4-substituted pyridine) were measured, and the ionization potentials observed below 12 eV are discussed. For Cr(CO)5.L, bands found in the region 7-8 eV were assigned to ionization from the d-orbitals. The IP values increase with the increasing electron acceptor nature of the ring substituents. The remaining bands below 12 eV were assigned to the pyridine orbitals. The IP values of the uncomplexed pyridine increase on complexation, and a comparison is made of the effects of complexation with the CR(CO)5 and BH3 moieties, MNDO calculations were utilized to explain the increases in a sub 2 (pi) and b sub 1 (pi) energies upon borane and boron trifluoride complexation. The increase in a sub 2 (pi) upon adduct formation can be related to changes in charge densities. Symmetry conditions prevent orbital interactions between the a sub 2 (pi) and pi components of the acid or substituent. Since the b sub 1 (pi) orbital can be perturbed by orbital interactions, a simple explanation for the energy changes of b sub 1 (pi) upon complexation is not possible. Dissert. Abstr.

N81-18152 Cornell Univ., Ithaca, N. Y.
MORE RELIABLE IDENTIFICATIONS OF UNKNOWN MASS SPECTRA USING THE PROBABILITY BASED MATCHING ALGORITHM Ph.D. Thesis
Barbara Lynn Atwater 1980 154 p
Avail: Univ. Microfilms Order No. 8102973

The increased use of gas chromatography/mass spectrometry (GC/MS) for the analysis of complex mixtures has greatly enhanced the need for reliable computer aided identification systems. The fastest and simplest of these are retrieval systems which identify an unknown by matching its spectrum against a library of previously identified spectra. In this research the reliability of unknown mass spectral identifications using the Probability Based Matching retrieval system (PBM) was significantly improved. These improvements were made through the addition of a spectrum subtraction algorithm, a spectrum tilting algorithm and a new method of ranking retrieved spectra. Dissert. Abstr.

N81-18153 Stanford Univ., Calif.
OPTICAL DIAGNOSTIC MEASUREMENTS OF COAL SLAG PARAMETERS IN COMBUSTION MHD SYSTEMS Ph.D. Thesis
Peter Carl Ariessohn 1980 183 p
Avail: Univ. Microfilms Order No. 8103481

A diagnostic technique capable of making continuous, in situ measurements of slag layer thickness was developed. This technique was then applied in a magnetohydrodynamic (MHD) system for comparison with the predictions of one of the existing hydrodynamic models. A diagnostic technique capable of making in situ measurements of ash droplet size and concentration at the exit of an MHD combustor was also developed and the sensitivity of these quantities was studied with respect to various combustion parameters. A slag layer surface position monitor employing a laser triangulation method was developed and used to measure variations in slag layer thickness as a function of substrate temperature for a variety of ash loadings and total reactant flowrates. These measurements, on both eastern and western coals, were in excellent agreement with theoretical predictions based on estimated properties of these slags. Slag layer thickness is shown to decrease with increasing substrate temperature and plasma velocity. Increased deposition rate, slag viscosity and thermal conductivity all led to increased slag layer thickness. Dissert. Abstr.

N81-18154 Stanford Univ., Calif.
INTRACAVITY ABSORPTION SPECTROSCOPY Ph.D. Thesis
Wendell Talbot Hill, III 1980 163 p
Avail: Univ. Microfilms Order No. 8103520

Intracavity absorption spectroscopy is a sensitive means of studying very weak absorption lines. The apparatus described was used to make the first laboratory detection of the extremely weak 3-0 band of the atmospheric bands in 16O2. The system maintains this sensitivity at ambient pressures as low as 50 Torr. With slight modifications to the laser system, the 2-0 band of 18O2 was measured. A close examination of the models governing the physics of intracavity absorption was made to determine how to maximize the sensitivity. An alternate steady state model was developed. Dissert. Abstr.

N81-18155 Oregon Univ., Eugene.
COHERENT ANTI-STOKES RAMAN SPECTROSCOPY OF GASES Ph.D. Thesis
Dennis Marc Guthals 1980 163 p
Avail: Univ. Microfilms Order No. 8100455

The development and applications of a 0.2/cm resolution Nd-YAG laser powered coherent anti-Stokes Raman spectroscopy (CARS) spectrometer for gas phase studies are described. Applications including CARS lineshape analysis, resonant CARS, and CARS of transient species and excited state molecules are reported. The intensity of the signal generated at the CARS frequency is governed by the behavior of the square of the nonlinear third order electronic susceptibility, which contains resonant, and nonresonant terms. The various nonlinear optical three wave mixing 3WM, processes which contribute to the intensity at the CARS frequency, are discussed. Dissert. Abstr.

N81-18156 City Univ. of New York, N. Y.
DYNAMIC LIGHT SCATTERING STUDIES OF COLLAGEN-GELATIN AND GEL Ph.D. Thesis
Jenn-Shyong Hwang 1980 148 p
Avail: Univ. Microfilms Order No. 8103935

The technique of intensity correlation spectroscopy using a digital autocorrelator was employed to investigate the collagen-gelatin and gel systems. Various hydrodynamic properties were derived from the autocorrelation functions of different samples. For the extremely polydisperse gelatin solution the concentration dependence of the diffusion coefficient was investigated and a relation for the polymerization index of the aggregates and the concentration was obtained. Single exponential autocorrelation functions were obtained for gelatin gels with and without crosslinking agent. The elastic continuum model was found to describe all the observed properties better than the bounded diffusion model. As the concentration increases the cooperative diffusion coefficient decreases in the solution state but increases in the gel state. Monodisperse collagen samples were obtained through the purification of density gradient separation.
Dissert. Abstr.

N81-18157 City Univ. of New York, N. Y.
SURFACE ENHANCED RAMAN SPECTRA OF MOLECULES ADSORBED ON SILVER ELECTRODES Ph.D. Thesis
Kathryn Adele Bunding 1980 99 p
Avail: Univ. Microfilms Order No. 8103914

The surface enhanced Raman spectra of 2-, 3-, and 4-methylpyridines on silver electrodes are reported and the vibrations assigned. Vibrational modes with dipolar components in the molecular plane and perpendicular to the surface are enhanced more than those in the molecular plane and parallel to the surface while vibrations out of the molecular plane and parallel to the electrode are also enhanced. Unless the molecules are tilted more than 45 degrees, these latter results are inconsistent with theories of surface enhancement which depend on dipole imaging. Dissert. Abstr.

N81-18158 Purdue Univ., Lafayette, Ind.
STUDIES OF SOLUTION STRUCTURE AND DYNAMICS BY MOLECULAR SPECTROSCOPY Ph.D. Thesis
Michael Walter Balk 1980 240 p
Avail: Univ. Microfilms Order No. 8102626

Information about the motional properties of the sodium ion in liquid pyridine was obtained from an experimental measurement of the sodium ion velocity time correlation function (vcf). The experimental vcf was obtained from the high resolution digital far infrared spectrum of the pyridine solution of sodium tetracarbonylcobaltate. The motional properties of the sodium ion in its pyridine environment were characterized by successfully modeling the experimental vcf with the molecular timescale generalized Langevin equation (MTGLE) theory. The high accuracy required in the far infrared spectrum necessitated two developments in infrared instrumentation. First, a computer spectrometer interactive

system was developed which is able to respond to the spectral data as it is being acquired in order to produce an absorbance spectrum with improved accuracy in the absorbance measurements and a constant noise level such that each spectral point has the same standard deviation. Second, a vacuum tight, solvent resistant, pathlength invariant sample cell was developed for high resolution far infrared spectroscopy of nonaqueous solutions.
Dissert. Abstr.

N81-18159 Purdue Univ., Lafayette, Ind.
STUDIES OF SOLUTION STRUCTURE AND ITS CHEMICAL REACTIVITY BY MOLECULAR SPECTROSCOPY Ph.D. Thesis
Soun Chanjamsri 1980 218 p
Avail: Univ. Microfilms Order No. 8102636

Solution structure of NaCo(CO)4 in 1,2 DME, THF and THP was studied by infrared spectroscopic technique. The NaCo (CO)4 salt existed in form of two, three and five kinds of anion sites in 1,2 DME, THF and THP respectively. Several types of ion site modifiers such as C211, C221, C222, H2O, NaB (C6H5)4 and (BzlPh3)PCo(CO)4, each with different effectiveness, were used for ion site conversion to help in sorting out the individual solution structurite. The anion sites found in those solutions are: site 1, solvent separated ion pair and free ion; site 2, contact ion pair; site 3, triple ions with two anions; site 4, triple ions with two cations; and site 5, close ion pair.
Dissert. Abstr.

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-18160 Connecticut Univ., Storrs.
STRESS CORROSION CRACKING OF AN ALUMINUM ZINC MAGNESIUM ALLOY Ph.D. Thesis
Louis A. Luini 1980 68 p
Avail: Univ. Microfilms Order No. 8103196

The stress corrosion cracking of a high strength aluminum zinc magnesium alloy of the type 7039 was studied as a function of heat treatment, test temperature, and environment. For each of four heat treatments, plots of log (crack velocity) versus stress intensity factor were obtained for testing in both distilled water and 3.5% NaCl - H2O. It was found that the overaged structure was most resistant to cracking, while the salt water environment was the most aggressive in promoting cracking. The fracture surface was distinguished by a distinct uncorroded region at the crack front. The region was largest in those samples tested in distilled water which had the slowest crack velocity and is thought to be caused by hydrogen embrittlement of the grain boundaries. However, activation energies obtained from comparing plateau velocities with test temperatures suggested that hydrogen embrittlement was not rate controlling. An activation energy of 12 kl/mole obtained in distilled water indicated concentration polarization was important and that of 85 kl/mole obtained in salt water indicated that activation polarization was involved. It was concluded that although hydrogen embrittlement might contribute to cracking, it is dissolution which dominates the fracture kinetics.
Dissert. Abstr.

N81-18161 Connecticut Univ., Storrs.
THEORY OF SUBSCALE FORMATION WITH A FINITE SOLUBILITY PRODUCT AND ITS APPLICATION TO THE INTERNAL CARBURIZATION OF Nb-Hf ALLOYS Ph.D. Thesis
Evan Keith Ohriner 1980 133 p
Avail: Univ. Microfilms Order No. 8103218

An analytical solution is derived which describes simultaneous diffusion and precipitation in a subscale. The solution has application to subscales formed by the process of internal oxidation, internal nitridation and internal carburization. Unlike previous analytical solutions, this solution is both consistent with parabolic kinetics and applicable for any value of the matrix solubility product of the precipitate components. The results of the solution can be used to predict the volume fraction of precipitate as a function of distance from the surface of the alloy. The derivation of the analytical solution requires that there is no long range diffusion of the metal species within the alloy and further assumes local equilibrium within the subscale. The derived solution is shown to be consistent with existing solutions which have been given for limiting values of precipitate solubility.
Dissert. Abstr.

N81-18162 Kentucky Univ., Lexington.
SOLID SOLUTION STRENGTHENING AND DUCTILE FRACTURE OF Ti-Al (CPH) AND Ti-Mo (BCC) ALLOYS Ph.D. Thesis
Wang Kuei-Hwa Chia 1980 187 p
Avail: Univ. Microfilms Order No. 8104461

Solid solution strengthening of polycrystalline Ti by Al and Mo at low temperatures was investigated regarding the increase in yield stress, strain hardening, and grain size hardening by concurrent measurements of the flow stress and the dislocation density. It was found that the flow stress increases linearly with the square root of the dislocation density relatively independent of strain and grain size. The ductile fracture behavior of Ti-Al and Ti-Mo alloys was studied with particular attention given to Bridgman's necking analysis, Cockcroft's fracture criterion, the growth of voids according to McClintock and the relation between fracture stress and dimple size proposed by Hahn and Rosenfield. The fracture toughness values obtained using the dimple size equal to the process zone size in Krafft's toughness model were in reasonable accord with those reported in the literature for Ti alloys.
Dissert. Abstr.

N81-18163 South Carolina Univ., Columbia.
CADMIUM-113 NMR STUDIES OF METALLOPROTEINS Ph.D. Thesis
David Bruce Bailey 1980 133 p
Avail: Univ. Microfilms Order No. 8102752

The rationale for selecting Cd-113 NMR and the various relaxation mechanisms available to Cd-113 in a metalloprotein are considered. Of all possible mechamisms, only two (dipole-dipole and chemical shift anisotropy) are shown to be major contributers to spin lattice relaxation. Scalar coupling mechanisms may also be important for spin-spin relaxation. Although chemical exchange processes are not considered in detail, these latter mechanisms probably contribute greatly to the overall linewidth of the Cd-113 resonance. The Cd-113 NMR of substituted bovine superoxide dismutase and of Cd(11) substituted Concanavalin A (Con A) are described. The theory and use of a computer program that simulates an NMR experiment are also discussed.
Dissert. Abstr.

N81-18164*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SEACOAST STRESS CORROSION CRACKING OF ALUMINUM ALLOYS
T. S. Humphries and E. E. Nelson Jan. 1981 29 p refs
(NASA-TM-82393) Avail: NTIS HC A03/MF A01 CSCL 11F

The stress corrosion cracking resistance of high strength, wrought aluminum alloys in a seacoast atmosphere was investigated and the results were compared with those obtained in laboratory tests. Round tensile specimens taken from the short transverse grain direction of aluminum plate and stressed up to 100 percent of their yield strengths were exposed to the seacoast and to alternate immersion in salt water and synthetic seawater. Maximum exposure periods of one year at the seacoast, 0.3 or 0.7 of a month for alternate immersion in salt water, and three months for synthetic seawater were indicated for aluminum alloys to avoid false indications of stress corrosion cracking failure resulting from pitting. Correlation of the results was very good among the three test media using the selected exposure periods. It is concluded that either of the laboratory test media is suitable for evaluating the stress corrosion cracking performance of aluminum alloys in seacoast atmosphere. R.C.T.

N81-18165*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF THERMAL CYCLING TO 1100 DEGREE C ON THE ALPHA (MO) PHASE IN DIRECTIONALLY SOLIDIFIED GAMMA/GAMMA PRIME-ALPHA ALLOYS
Fredric H. Harf 1981 15 p refs Presented at the 110th

Ann. Meeting of the Am. Inst. of Mining, Met. and Petrol. Eng., Chicago, 22-26 Feb. 1981
(NASA-TM-81688; E-725) Avail: NTIS HC A02/MF A01 CSCL 11F

In gamma/gamma prime - alpha eutectic alloys (Ni-Mo-Al), the resistance of the alpha phase to morphological changes during thermal cycling was found to be dependent on the structure formed during directional solidification. Fine, smooth alpha fibers survived up to 1000 five minute cycles to 1100 C with minor microstructural contour changes, while coarser and irregularly shaped alpha fibers tended to spheroidize. A mechanism to explain this phenomenon is proposed. It is suggested that on heating to 1100 C, the alpha phase is likely to undergo morphological changes, until differential thermal expansion creates a stress free interface between the alpha phase and the gamma/gamma prime matrix. Author

N81-18166# National Bureau of Standards, Washington, D.C. Metallurgy Div.
APPLICATION OF SOLIDIFICATION THEORY TO RAPID SOLIDIFICATION PROCESSING Semiannual Technical Report, 1 Apr. - 30 Sep. 1980
W. J. Boettinger, J. W. Cahn, S. R. Coriell, J. R. Manning, and R. J. Schaefer Nov. 1980 14 p
(ARPA Order 3751)
(AD-A094285) Avail: NTIS HC A02/MF A01 CSCL 11/2

The objective of this work is to develop guidelines based on kinetic and thermodynamic solidification theory for prediction and control of rapid solidification processes. In particular, segregation effects and rules governing the formation of equilibrium and non-equilibrium phases, including metallic glasses, will be investigated. Areas where significant improvements in alloy properties can be produced by rapid solidification will be emphasized. GRA

N81-18167# Materials Research Labs., Ascot Vale (Australia).
HIGH-TEMPERATURE OXIDATION OF NIMONIC 105 AT SUB-ATMOSPHERIC OXYGEN PARTIAL PRESSURES
Graham R. Johnston Oct. 1980 34 p refs
(AD-A094390; MRL-R-789) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report describes studies of some high-temperature oxidation characteristics of the wrought superalloy Nimonic 105. This work is related to the development of a high-temperature brazing process for military gas-turbine aerofoil components involving gaseous atmospheres of very low oxygen activity. GRA

N81-18168# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
HYDROGEN EFFECTS IN NICKEL-EMBRITTLEMENT OR ENHANCED DUCTILITY
J. Eastman, T. Matsumoto, N. Narita, F. Heubaum, and H. K. Birnbaum Nov. 1980 15 p refs
(Contract N00014-75-C-1012; Grant NSF DMR-77-09808)
(AD-A094271) Avail: NTIS HC A02/MF A01 CSCL 11/6

In the present work we have attempted to study hydrogen-related fracture of nickel using a variety of experimental methods with the principle aim of establishing the mechanism of fracture. Fracture of nickel was studied in low pressure hydrogen gas and for specimens containing solute hydrogen using slow strain rate tension tests. Both intergranular and transgranular fracture was observed on testing in hydrogen gas depending on the heat treatment and on the pressure of trace impurities such as S, Mn, and Mg. The intergranular fracture mode was correlated with the segregation of S to the grain boundaries as measured by Auger and SIMS techniques. Specimens containing solute hydrogen fractured in an intergranular mode for all heat treatments. Detailed examination of both the intergranular and transgranular fracture surfaces indicated that neither was a truly 'brittle' fracture mode but that both indicated a high degree of local ductility. The effect of hydrogen on the plastic properties of nickel was examined using stress strain techniques and in situ deformation in an environmental cell in the HVEM. It was shown that hydrogen decreases the flow stress of nickel. In situ environmental cell fracture studies in hydrogen gas in the HVEM showed that the fracture process resulted from locally enhanced deformation at the crack tip due to the presence of hydrogen. This was confirmed by in situ fracture studies in the SEM. GRA

N81-18169# San Fernando Labs., Pacoima, Calif.
INVESTIGATION OF CNTD MECHANISM AND ITS EFFECT ON MICROSTRUCTURAL PROPERTIES Final Report, 20 Sep. 1978 - 20 Sep. 1979
Deepak G. Bhat Oct. 1980 89 p refs
(Contract N00019-78-C-0557)
(AD-A094242) Avail: NTIS HC A05/MF A01 CSCL 13/8

This report presents results of a research program in which we sought to develop a chemical vapor deposition (CVD) method for the deposition of extremely fine grained silicon nitride. The program consisted of three separate technical efforts. The first effort, a parametric study of the conventional silicon tetrahalide-ammonia CVD chemistry, produced no significant grain refinement in the Si3N4 deposits. The second effort attempted, with no success, to utilize silicon halide disproportionation chemistry in the CVD process. Finally, we observed an apparently successful Si3N4 grain refinement during the third effort in which we used the competing codeposition of separate phases to interrupt grain growth. During this effort, we tried the codeposition of silicon nitride and silicon carbide with no success. However, we found apparently good results when silicon nitride was codeposited with aluminum nitride. GRA

N81-18170# TRW, Inc., Cleveland, Ohio. Materials Technology.
P/M PROCESSING OF RARE EARTH MODIFIED HIGH STRENGTH STEELS Technical Report, 1 Oct. 1979 - 30 Sep. 1980
A. A. Sheinker Dec. 1980 67 p refs
(Contract N00014-78-C-0672; NR Proj. 036-132)
(AD-A094185; TRW-ER-8097-2) Avail: NTIS HC A04/MF A01 CSCL 11/6

Material processing studies were continued directed toward developing powder metallurgy methods for producing rare earth modified high strength 4340 steel with improved resistance to hydrogen embrittlement. Three different methods of making rare earth modified 4340 steel powders were investigated: hydrogen gas atomization, mechanical alloying, and rapid solidification atomization. Hot extrusion consolidation of hydrogen gas atomized 4340 steel powders at 2150 F (1450 K) resulted in much better mechanical properties after heat treatment than hot isostatic pressing (HIP) consolidation at 2100 F (1420 K), but the ductility and impact resistance properties of the extruded powders were generally lower than those of similarly heat treated, rare earth modified, wrought 4340 steels evaluated previously, at approximately the same rare earth (cerium) content. Hot extrusion consolidation of 4340 steel powder which was mechanically alloyed with either 75% Ce-25% Ni or LaNi5 alloy powders by attriting in a special high-intensity ball mill resulted in higher strength but lower ductility and impact resistance after heat treatment than the previously evaluated wrought 4340 steels at approximately the same rare earth content. Rapid solidification atomization of 4340 steel prealloyed with cerium by adding a 75% Ce-25% Ni alloy to the melt, using both the rapid solidification rate (RSR) and commercial rapid solidification (CRS) processes, resulted in very low cerium recoveries due to vaporization of the cerium in the RSR process and oxidation of the cerium in the CRS process. Because these difficulties could not be resolved within the scope of the program, no further work was performed on rapidly solidified powders. GRA

N81-18171# Illinois Inst. of Tech., Chicago. Dept. of Metallurgical and Materials Engineering.
THE MECHANISMS OF CRACK INITIATION AND CRACK PROPAGATION IN METAL INDUCED EMBRITTLEMENT OF METALS. PART 2: THEORETICAL ASPECTS OF CRACK INITIATION Technical Report, 1 Jun. 1979 - 31 Dec. 1980
Paul Gordon 15 Dec. 1980 32 p refs
(Contract N00014-79-C-0580; Grant NSF DMR-79-08674)
(AD-A094528; TR-12-15-80) Avail: NTIS HC A02/MF A01 CSCL 20/11

Metal-induced embrittlement (MIE) of 4140 steel by indium has been studied using delayed failure tensile tests. The temperature and stress dependence of the kinetics of crack initiation and crack propagation in both liquid metal-induced and solid metal-induced cracking have been examined in the same system for the first time in MIE. This was done using electrical potential-drop measurements along the indium-covered portion

of the sample gage length to record the start and progress of cracking, and also through fractographic observations. In Part 1 of the report of this work, the experimental results are presented and their implications with regard to crack propagation are discussed. In Part 2, various mechanisms proposed in the literature for crack initiation are evaluated in the light of the experimental results and other known characteristics of MIE, and a new mechanism is proposed which, it is believed, synthesizes and rationalizes the available evidence best. GRA

N81-18172# Stanford Univ., Calif. Dept. of Materials Science and Engineering.

A FUNDAMENTAL STUDY OF THE PROCESSING OF OXIDE DISPERSION STRENGTHENED METALS Final Scientific Report

William D. Nix Nov. 1980 39 p refs

(Grant AF-AFOSR-3128-77; AF Proj. 2306)

(AD-A094509; AFOSR-81-0013TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The purpose of this research is to develop a better understanding of the structure and properties of oxide dispersion strengthened (ODS) metals. The main thrust of this work has been to understand the mechanical alloying process by which many ODS alloys are now made and to synthesize new structural materials with mechanical alloying. We are also interested in the mechanisms by which elongated grain structures form during the processing of ODS alloys. Some of our recent work has been directed toward the understanding of the high temperature mechanical properties of ODS aluminum alloys. GRA

N81-18173# Massachusetts Inst. of Tech., Cambridge.

THE ROLE OF GRAIN BOUNDARY CHEMISTRY AND THE ENVIRONMENT ON INTERGRANULAR FRACTURE

R. M. Latanision, M. Kurkela, and F. Lee Oct. 1980 24 p refs

(Contract N00014-78-C-0002)

(AD-A094045; TR-5) Avail: NTIS HC A02/MF A01 CSCL 20/2

In this discussion the influence of grain boundary segregates and their interaction with the environment will be discussed with particular reference to hydrogen-induced intergranular embrittlement. Many of the elements which are found segregated at grain boundaries (i.e., the metalloid elements) are catalyst poisons for the hydrogen evolution reaction in electrolytes and, hence, stimulate hydrogen absorption. The use of glassy metal alloys (transition metal-metalloid type) as grain boundary analogs in studying hydrogen absorption and permeation is explored. Likewise, permeation experiments which distinguish between lattice, grain boundary and dislocation transport mechanisms will be discussed. GRA

N81-18174# Texas Univ. at Austin. Dept. of Chemistry.

THE BONDING IN SOME BIS(ARENE)CHROMIUM COMPOUNDS AS INDICATED BY UV PHOTOELECTRON SPECTROSCOPY

D. E. Cabelli, A. H. Cowley, and J. L. Lagowski 22 Dec. 1980 16 p refs Submitted for publication

(Contract N00014-76-C-0577; NR Proj. 053-612)

(AD-A094180; TR-80-02) Avail: NTIS HC A02/MF A01 CSCL 07/4

He(1) ultraviolet photoelectron (UV-PES) spectra are reported for several bis(arene)chromium compounds. The arenes concerned are m-trifluoro-methylbenzotrifluoride, p-fluorobenzetrifluoride, p-difluorobenzene, m-dichlorobenzene, fluorobenzene, chlorobenzene, methylbenzoate, p-chlorotoluene, diphenyl ether, toluene, o-xylene, trimethylsilylbenzene, isobutylbenzene, 1,2,3-trimethyibenzene, 1,3,5-trimethylbenzene, and 1,2,4,5-tetremethylbenzene. The spectra have been interpreted using a qualitative perturbation molecular orbital model. The two major findings of the work are: (1) the ionizations from the metal-localized a sub 1g and e sub 2g molecular orbitals are governed primarily by ligand electronegativity, but there is some evidence for the operation of conjugative effects, and (2) the ionization energies of the free and coordinated arenes are quite similar. GRA

N81-18175# Phrasor Scientific, Inc., Duarte, Calif.

DEVELOPMENT OF A TABLETOP MODEL FOR THE GENERATION OF AMORPHOUS/MICROCRYSTALLINE METAL POWDERS Interim Technical Report, 1 May 1978 - 30 Apr. 1980

John F. Mahoney, Juliús Perel, Zef Shanfield, and Bernard E. Kalensher 30 Apr. 1980 166 p refs

(Contract N00014-77-C-0373; ARPA Order 3363)

(AD-A093645; Rept-80-1) Avail: NTIS HC A08/MF A01 CSCL 13/8

Electrohydrodynamics (EHD) has been explored for the generation and control of charged liquid droplets in order to produce micro-size particles and splat coatings. The aim of this work is the development of a Tabletop Powder Generator capable of controlled production of powder sizes that are both smaller and more narrowly distributed than those produced by conventional atomizers. This tool is being designed for use in fundamental studies of the effect of solidification variables on microstructures and the development of new alloy compositions attainable through rapid solidification processing. The EHD technique requires the use of intense electric fields to generate liquid droplets directly from the liquid state. This is achieved by delivering a molten alloy to the tip of a fine capillary nozzle to which high voltage is applied. A variety of droplet source configurations and materials were explored on this program. Resistance heater technology was improved resulting in greater reliability and temperatures of 1800 K were achieved while experiencing minimal erosion. Several modes of source operation were encountered depending upon the interaction of the molten metals with source materials. Rapid solidification and cooling rates of beam droplets in a vacuum environment have been analyzed from novel points of view. Powders smaller than 0.01 micron have been produced with calculated cooling rates of approximately 10,000,000 K/s from radiation cooling alone. GRA

N81-18176# Hanford Engineering Development Lab., Richland, Wash.

HYDROGEN PERMEABILITY THROUGH RHENIUM AND A MOLYBDENUM/THENIUM ALLOY WITH AND WITHOUT A CVD TUNGSTEN COATING

R. C. Svedberg Apr. 1980 14 p refs Presented at the Intern. Conf. on Met. Coatings, San Diego, Calif., 21 Apr. 1980

(Contract DE-AC14-76FF-02170)

(HEDL-SA-2188; CONF-800439-13) Avail: NTIS HC A02/MF A01

Hydrogen permeability through tubes made from CVD rhenium, CVD rhenium coated with CVD tungsten, wrought Mo/Re and wrought Mo/Re coated with CVD tungsten was determined. The tubes were 0.32 cm inside diameter amd 30.48 cm long. Hydrogen permeability through a CVD tungsten tube was also determined for comparison and control purposes. The technique used to measure the permeability utilized ultrahigh vacuum and mass spectrometric methods using resistively heated test samples. Permeability was measured between 1473 K and 2073 K. The hydrogen permeability driving pressures, 4 to 30 torr, were provided by an Ar/4% H2 gas mixture. The hydrogen permeability measurements were made to evaluate the applicability of the Re, Mo/Re, and these materials coated with CVD W as a muffle material for an 1800 C, Ar/H2 atmosphere, thermally efficient sintering furnace. The measured permeation rates follow the equation P = P sub o exp (-0 sub p/RT). The permeation rate equations measured for the various materials are listed below. Units are torr. liter./cm/s/cu torr. R.C.T.

N81-18177# California Univ., Livermore. Lawrence Livermore Lab.

ACOUSTIC EMISSION UNDER BIAXIAL STRESSES IN UNFLAWED 21-6-9 AND 304 STAINLESS STEEL

M. A. Hamstad, E. M. Leon, and A. K. Mukherjee 31 Oct. 1980 36 p refs Presented at the Conf. on Elastic Waves and Microstructures, Oxford, England, 16-17 Dec. 1980

(Contract W-7405-eng-48)

(UCRL-84358; CONF-801221-1) Avail: NTIS HC A03/MF A01

Acoustic emission testing was carried out with uniaxial and biaxial (2:1 stress ratio) stressing of smooth samples of 21-6-9 and 304 stainless steel. Uniaxial testing was done with simple tensile and compression samples as well as with the special biaxial specimens. Biaxial tensile stressing was accomplished with a specially designed specimen, which had been

used previously to characterize AE in 7075 aluminum under biaxial stressing. Results were obtained for air melt and for vacuum melt samples of 21-6-9 SS. The air melt samples contain considerably more inclusion particles than the vacuum melt samples. For the 304 SS, as received material was examined. To allow AE correlations with microstructure, extensive characterization of the 21-6-9 microstructure was carried out. Significant differences in AE occur in biaxially stressed specimens as compared to uniaxially stressed samples. DOE

N81-18178# Houston Univ., Tex. Dept. of Physics.
MICROSTRUCTURAL STUDIES OF HYDROGEN AND DEUTERIUM IN BCC REFRACTORY METALS
S. C. Moss 1980 14 p refs
(Contracts DE-AS05-76ER-05111; EY-76-S-05-5111)
(DOE/ER-05111/3) Avail: NTIS HC A02/MF A01

Because the microstructural atomic arrangements in alloys of hydrogen and deuterium with bcc refractory metals are interstitial phases in which the host metal lattice is substantially deformed by the incorporation of the H, (D) atoms, there are pronounced X-ray scattering effects. X-ray diffraction was used to determine the degree to which phase relations and solid solution properties in metal hydride alloys depend on the hydrogen hydrogen interaction via displacement field of the metal atoms. Topics discussed include: (1) metal atom modulation in V2D and V2H; (2) elastic displacement in dilute H-Nb and H-Ta alloys; (3) critical wetting and the thermal expansion anomaly in H-Nb; (4) deuterium in Ta; (5) positron annihiliation in Ta-H; (6) interstitials in Pb; and (7) potassium intercalation in graphite. DOE

N81-18179# Japan Atomic Energy Research Inst., Tokyo. Div. of Nuclear Fuel Research.
CORROSION OF AISI 316 AND AISI 304 STAINLESS STEEL WITH IODINE VAPOR
Tekeshi Fukuda and Shunzo Omori 1980 34 p refs
(Contract W-7405-eng-26)
(ORNL-TR-4694) Avail: NTIS HC A03/MF A01

The weight loss of stainless steel in corrosion with iodine vapor was studied at 500 to 1000 C and an iodine vapor pressure range of 0.05 to 0.5 mm Hg, using a thermobalance. In the initial stage of corrosion, the weight loss rate is largely influenced by solution treatment or surface treatment; the induction period, observed for solution treated samples, is shortened or eliminated by fission fragment irradiation, ion bombardment or mechanical polishing, and in some cases corrosion is even accelerated by the surface treatments. A constant weight loss region follows the initial stage of corrosion. In this region, the weight loss rate is not dependent on treatment to the samples, and has a linear relationship with the vapor pressure of iodine. The rate is the largest at about 800 and 750 C for AISI 316 and AISI 304. The rates in general are larger for AISI 304 than for AISI 316 below 700 C but almost the same above 800 C. Corrosion product layer is observed on the surface of the sample below 700 C. Based on these findings, the corrosion process is discussed. The deposition of corrosion product in a temperature gradient tube is also described. DOE

N81-18180# Argonne National Lab., Ill.
EVALUATION OF ALKALI METAL SULFATE DEW POINT MEASUREMENT FOR DETECTION OF HOT CORROSION CONDITIONS IN PFBC FLUE GAS
James E. Helt Nov. 1980 53 p refs
(Contract W-31-109-eng-38)
(ANL/CEN/FE-80-12) Avail: NTIS HC A04/MF A01

When coal is the fuel for combustion, hot corrosion may occur in the form of accelerated sulfidation. It is generally agreed that molten alkali metal sulfates (Na2SO4 and K2SO4) are the principal agents responsible for the occurrence of sulfidation. Although molten sodium sulfate by itself appears to have little or no effect on the corrosion of metal alloys, its presence may increase the accessibility of the bare metal surface to the external atmosphere. If this atmosphere contains either a reductant and/or an oxide such as SiO2, SO3, or NaOH(Na2O), corrosion is likely to occur. Alkali metal sulfate dew point measurement was evaluated as a means of anticipating hot corrosion in the gas turbine of a pressurized fluidized bed combustion system. The hot corrosion mechanism and deposition rate theory were reviewed. Two methods of dew point measurement, electrical conductivity and remote optical techniques, were identified as having a potential for this application. Both techniques are outlined; practical measurement systems are suggested; and potential problem areas are identified. DOE

N81-18181# Oak Ridge National Lab., Tenn.
DEPENDENCE OF STABILITY OF METASTABLE SUPERCONDUCTORS ON COPPER FRACTION
S. A. Elrod, J. W. Lue, J. R. Miller, and L. Dresner Dec. 1980 40 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7517) Avail: NTIS HC A03/MF A01

The stability of composite superconductors operating in the metastable regime depends upon such factors as matrix resistivity, cooled surface dimensions, fraction of critical current, and volume fraction of stabilizer. By assuming constant thermophysical properties, analytic expressions were developed for the energy and voltage of the minimum propagating zone (MPZ). With other factors held constant, these expressions were used to predict composite superconductor stability as a function of copper fraction: lower copper fractions lead to higher MPZ energies. The MPZ voltages were measured for three NbTi/Cu composites having different copper fractions and different critical current densities for several magnetic fields and transport currents. Experimental MPZ voltages were used to calculate an effective heat transfer coefficient, which was subsequently used to calculate the MPZ energy. The experimental MPZ energies support the theoretical expectation that lower copper fractions lead to higher stability in the metastable regime. DOE

N81-18182# Dow Chemical Co., Freeport, Tex.
A STUDY OF THE EFFECTS OF INTERLEAKAGE OF AMMONIA AND SEAWATER ON CORROSION AND SCALING OF CANDIDATE MATERIALS FOR OTEC HEAT EXCHANGERS Final Report
W. D. Grimes, C. F. Schrieber, and J. A. Manning Jul. 1980 102 p refs
(Contract W-31-109-eng-38)
(ANL/OTEC-BCM-012) Avail: NTIS HC A06/MF A01

Assessment was made on the effect of small concentrations of ammonia in seawater and varying concentrations of seawater in anhydrous ammonia upon corrosion and scaling of candidate OTEC heat exchanger materials - AL-5052, Alclad 3003, copper alloys 706, 715 and 722, AL-6X stainless steel and CP titanium. Results indicate that AL-6X stainless steel and CP titanium show exceptional corrosion resistance to all test environments. Aluminum clad alloy 3003 showed satisfactory performance in seawater and seawater plus ammonia environments. Only minimal pitting was observed and this was limited to the sacrificial cladding in seawater plus ammonia only. Cladding alloy 7072 showed unacceptable corrosion resistance in anhydrous ammonia containing low seawater concentrations. The Al-5052 tubes showed unsatisfactory corrosion behavior in the presence of seawater flow with ammonia interleakage. The copper alloys considered showed unacceptable corrosion resistance in all seawater environments containing ammonia. Low pressure differentials between seawater and anhydrous ammonia in the tube testing unit resulted in scaling and moderately efficient plug seal formation at the artificial leak sites of the tubes. It is recommended that Alclad 3003, CP titanium and AL-6X stainless steel tubes be assessed for suitability in the presence of probable OTEC cleaning systems. DOE

N81-18183# Hanford Engineering Development Lab., Richland, Wash.
FATIGUE-CRACK GROWTH BEHAVIOR IN FERRITIC ALLOYS FOR POTENTIAL GCFR STRUCTURAL APPLICATIONS
L. A. James Dec. 1980 31 p refs
(Contract DE-AC14-76FF-02170)
(HEDL-TME-80-71) Avail: NTIS HC A03/MF A01

The fatigue crack growth behavior of two ferritic steels (Modified 9Cr-1Mo and HT-9) was studied over the temperature range 24 to 538 C. Crack growth rates increased with increasing temperature, but at a given temperature, there was little or no difference in the behavior of any of the three alloys. Little effect

of crack orientation was also noted at any of the test temperatures. DOE

N81-18184# Ames Lab., Iowa. Dept. of Materials Science and Engineering.
MAGNETIC AND CRYSTALLIZATION BEHAVIOR OF Be-SUBSTITUTED Fe82B18 METALLIC GLASSES
C. S. Severin and C. W. Chen 1980 10 p refs Presented at the 26th Ann. Conf. on Magnetism and Magnetic Metals, Dallas, Tex., 11-14 Nov. 1980
(Contract W-7405-eng-82)
(IS-M-303; CONF-801134-12) Avail: NTIS HC A02/MF A01

The partial substitution of divalent Be for trivalent B in the amorphous Fe(sub 82) B (sub 18) was shown to cause an increase and subsequent decrease in the Fe moment. This reversing effect of Be was confirmed by Auger electron and Mossbauer spectroscopy results, which point to a charge transfer from Be to the d band of Fe for Be contents up to 4 at .% and to the dissappearance of the charge transfer from Be at higher Be contents. The Curie temperatures of the Fe(sub 82)B(sub 18-y)Be(sub y) alloys monotonously decreased, a result which deviates from the behavior of the metalloid-substituted Fe-B alloys. The annealing behavior of the present alloys was similar to that of the latter alloys. E.D.K.

N81-18185# California Univ., Berkeley. Materials and Molecular Research Div.
CORROSION OF IRON Ph.D. Thesis
Clarence Garlan Law, Jr. Nov. 1980 153 p refs
(Contract W-7405-eng-48)
(LBL-11305) Avail: NTIS HC A08/MF A01

In this dissertation three problems relevant to the electrochemical aspects of iron are treated. In the first problem, a model was developed for the anodic dissolution of iron in a sulfuric acid solution. Current and potential distribution validate experimentally obtained z-shaped polarization curves. In the second problem mass-transfer rates on rotating disks and rings are calculated when the flow regime may vary from laminar near the center to fully developed turbulent flow near the periphery. These results are subsequently used in a model which calculates corrosion rates on a disk rotating in sea water. On a completely different topic, the current and potential distributions on a dropping-mercury electrode are calculted below the limiting current. Results are generated in terms of two dimensionless parameters. DOE

N81-18186# Oak Ridge National Lab., Tenn. Task Group on Alloy Development for Irradiation Performance.
ALLOY DEVELOPMENT FOR IRRADIATION PERFORMANCE Quarterly Progress Report
Dec. 1980 216 p refs
(Contract W-7405-eng-26)
(DOE/ER-0045/4) Avail: NTIS HC A10/MF A01

This report is organized along topical lines in parallel to a Program Plan of the same title so that activities and accomplishments may be followed readily relative to that Program Plan. Thus, the work of a given laboratory may appear throughout the report. Chapters 1, 2, 8, and 9 review activities on analysis and evaluation, test methods development, status of irradiation experiments, and corrosion testing and hydrogen permeation studies, respectively. These activities relate to each of the alloy development paths. Chapters 3, 4, 5, 6, and 7 present the ongoing work on each alloy development path. The Table of Contents is annotated for the convenience of the reader. Author

N81-18187# Westinghouse Research and Development Center, Pittsburgh, Pa.
EVALUATION OF HYDROGEN EMBRITTLEMENT IN Cr-Mo PRESSURE VESSEL STEELS
B.J. Shaw and E. W. Johnson 24 Aug. 1980 36 p refs
(Contract DE-AC05-78ET-13513)
(DOE/ET-13513/T4; Rept-1) Avail: NTIS HC A03/MF A01

Commercial 2 1/4 Cr-1 Mo low strength steel specimens were tested to measure their susceptibility of hydrogen embrittlement in an environment of H2S at 50 psig. The plane stress zones on the crack front in compact tension specimens and incubation time effects seriously confounded measurements on these steels when tested by conventional rising load experiments. Because of the incubation time effect, K/sub or/ (the stress intensity at which cracking starts in a rising load test) is a loading rate dependent variable and is usually significantly greater than the arrest stress intensity, K/sub arr/ in a bolt loaded test. K/sub arr/ must therefore be used as a measure of hydrogen resistance. The incubation time was significantly reduced by cyclicly loading in the environment to initiate the crack and K/sub arr/ was measured by holding the specimen in constant displacement immediately after crack initiation. As an example of the importance of these effects a 3T CT smooth sided specimen was compared with a side grooved 2T CT specimen of the same steel. DOE

N81-18188# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
DEVELOPMENT OF A HIGH STRENGTH, HYDROGEN-RESISTANT AUSTENITIC ALLOY
K. M. Chang, D. H. Klahn, and J. W. Morris, Jr. Aug. 1980 10 p refs Presented at the Intern. Conf. on Effects of Hydrogen on Materials, Jackson Hole, Wyo., 26-30 Aug. 1980
(Contract W-7405-eng-48)
(LBL-11239; CONF-800850-4) Avail: NTIS HC A02/MF A01

Research toward high strength, high toughness nonmagnetic steels for use in the retaining rings of large electrical generators led to the development of a Ta-modified iron based superalloy (Fe-36 Ni-3 Ti-3 Ta-0.5 Al-1.3 Mo-0.3 V-0.01 B) which combines high strength with good toughness after suitable aging. The alloy did, however, show some degradation in fatigue resistance in gaseous hydrogen. This sensitivity was associated with a deformation induced martensitic transformation near the fracture surface. The addition of a small amount of chromium to the alloy suppressed the martensite transformation and led to a marked improvement in hydrogen resistance. DOE

N81-18189# Sandia Labs., Livermore, Calif. Theoretical Div.
HYDROGEN TRAPPING IN FCC METALS
G. J. Thomas Oct. 1980 20 p refs Presented at the TMS-AIME 3rd Intern. Conf. on the Effect of Hydrogen of Behavior of Mater., Jackson, Wyo., 26-31 Aug. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-8656; CONF-800850-3) Avail: NTIS HC A02/MF A01

Desorption measurements were employed to study trapping in cold-worked and impurity-doped nickel. The data were analyzed using numerical solutions to diffusion models to obtain trap binding energies. The present results, as well as literature data, indicate low binding energies relative, to bulk diffusional activation energies in nickel and austenitic steels, in contrast to the ferritic case. This suggests that enhancement of hydrogen concentrations at trap sites may not be very large. The small binding energies to defect strain fields indicate that hydrogen in solution induces a small lattice relaxation in these metals. DOE

N81-18190# Los Alamos Scientific Lab., N. Mex.
AUTOMATED APPARATUS FOR SIEVERTS' STUDIES OF METAL HYDRIDES
Dean H. W. Carstens and W. R. David Dec. 1980 17 p refs Sponsored by DOE
(LA-8534-MS) Avail: NTIS HC A02/MF A01

An automated system, controlled by a small desktop computer, that carries out Sieverts' experiments on metal hydride systems is described. Data (equilibrium pressures versus temperatures at constant hydrogen-to-metal ratios) are recorded for later analysis and plotting. The computer also controls valve positions during the experiments. Results for two metal hydride systems, the uranium deuteride system in the plateau region and the La5 25Ni hydride system at low concentrations, are presented as examples. Data included on the latter system have not been reported previously. The techniques used in Sieverts' experiments and the sources of errors are discussed. DOE

N81-18191 California Univ., Los Angeles.
SUPERPOSITION OF PRECIPITATION HARDENING MECHANISMS IN GAMMA-PRIME-HARDENABLE ALLOYS: A COMPUTER RESEARCH ANALYSIS Ph.D. Thesis
Eue-Jae Lee 1980 224 p
Avail: Univ. Microfilms Order No. 8102852

Some calculations of the forces for a single dislocation and

also a pair of dislocations are presented. Calculations were performed with fixed values of the relevant parameters characteristic of gamma precipitates in Ni-Al alloys. The values of volume fraction, and the yield stress were calculated using the computation results obtained at the slip-plane position Z = 0.619. Also, the contribution of each mechanism to the overall strengthening for the case where mixed hardening (the order and misfit hardening mechanisms) is operative was evaluated. The results show excellent agreement with experimental data in the limited number of cases where it could be applied. Several conclusions were reached: (1) the straight dislocation approximation is reliable only for weak particles; (2) the single dislocation approach can be used as an excellent approximation for the calculation of the yield stress, provided the factor of two is taken into account and a term is considered, where gamma 5 is the APB energy of the precipitate; and (3) in precipitation hardening of gamma/gamma alloys, the APB hardening mechanism dominates for under-aged alloys. Dissert. Abstr.

N81-18192 California Univ., Los Angeles.
THE STRUCTURAL STUDY OF METALLIC GLASSES USING VARIABLE TWO THETA AND VARIABLE ENERGY X-RAY DIFFRACTION TECHNIQUES Ph.D. Thesis
Dokyol Lee 1980 263 p
Avail: Univ. Microfilms Order No. 8102851

The partial and total interference functions of Ni-Ti-(Zr) and Ni-Zi-(HF) alloys were determined. While the Fourier transforms of the total interference functions for the Ni-Ti-(Zr) glasses possess broad first peaks, the first peaks in those for the Ni-Zr(Hf) glasses are split into two subsidiary peaks, the first for Ni-Zr correlation and the second for Zr-Zr correlation. For both the amorphous Ni(40)Ti(60) and Ni(35)Zr(65) alloys, the Percus-Yevick hard sphere model fails to describe the structural features in these alloys. The local atomic arrangement in these amorphous alloys seems to be similar to that observed in the crystalline NiTi(NiZr) or NiTi2(NiZr2) phase. Dissert. Abstr.

N81-18011*# Lockheed-California Co., Burbank.
ADVANCED MATERIALS AND FABRICATION PROCESSES FOR SUPERSONIC CRUISE AIRCRAFT
Marlon K. Guess, Russell S. Kaneko, and George G. Wald *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1981 p 687-712 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 11F

N81-18012*# Douglas Aircraft Co., Inc., Long Beach, Calif.
EFFECTS OF AN AST PROGRAM ON US TITANIUM STORY
Richard D. Fitzsimmons *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 713-736 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 11F

N81-18255# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HARDENING AND FATIGUE DAMAGE INTERACTION IN 316 L STEEL
Jean-Louis Chaboche, Henri Kaczmarek, and Pascal Raine (Ecole Norm. Super. de l'Enseignement Tech.) *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 35-55 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 177-196 Original report in FRENCH previously announced as A80-43547 (For primary document see N81-18251 09-31)
Avail: NTIS HC A05/MF A01

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-18193 Tennessee Univ., Knoxville.
STRESS-STRAIN TESTING AND MASS DETERMINATION OF TEXTILE FIBERS Ph.D. Thesis
Roberto Lenarduzzi 1980 134 p
Avail: Univ. Microfilms Order No. 8104603

The design and development of a fiber breaking instrument for cotton quality testing is presented. The instrument is capable of measuring the stress-strain parameters, namely the breaking load and the elongation of the fibers. Furthermore, the measurement of the mass per unit length of the cotton specimen is an integral operation of the instrument accomplished without having to remove it from the holding clamps. This addition makes the tester unique in its field and significantly increases the rate of cotton specimen testing. The breaking load and elongation of the specimen are determined by straining the cotton fibers clamped between two jaws. The standard flat bundle method is used as outlined by the American Society of Testing and Materials. The movement separating the specimen holding clamps is produced by a stepping motor and gear system. The mass of the specimen is determined optically. Fiber optics technology is used to bridge the gaps between light source and specimen and between specimen and detector. Scanning of the specimen across the width is provided electronically by the line detector.
Dissert. Abstr.

N81-18194 Stevens Inst. of Tech., Hoboken, N. J.
MECHANICAL BEHAVIORS OF PARTICULATE SOLIDS AND ITS RAMIFICATION TO POLYMER PROCESSING Ph.D. Thesis
Chia Yung Cheng 1980 236 p
Avail: Univ. Microfilms Order No. 8100851

A large number of polymeric particulate solids were investigated for their behavior under external stresses. The mechanical response of particulate solids was found to depend on the state of consolidation and the inherent viscoelastic properties of the polymer. A mathematical model was proposed to predict the bulk density in terms of pressure and material modulus. The structural concept was introduced to represent the force field in a particulate mass. Actual contact areas of the particulate solids with rigid walls were measured at different pressures and temperatures. Different melting phenomena of the particulate solids was observed. A device was designed and constructed which measures the friction behavior of the particulate under different states of consolidation, speed, and temperature.
Dissert. Abstr.

N81-18195 California Univ., Los Angeles.
VIBRATIONAL SPECTRA AND STRUCTURE OF FLUOROZIRCONATE GLASSES Ph.D. Thesis
Rui Manuel Amaral De Almeida 1980 168 p
Avail: Univ. Microfilms Order No. 8103981

The structure of fluorozirconate glasses in the ZrF4-BaF2 system and mixed anion chlorofluorozirconate glasses in the ZrF4-BaCl2 system was studii by vibrational spectroscopy. The structure was discussed in terms of nearest neighbor zirconium coordination and how the coordination polyhedra linked together to form the glass network was described. The vibrational spectral data were analyzed according in part to a modification of a model recently proposed for for tetrahedral glasses. The degree of localization of the different modes varied with their frequency. The results of the present investigation suggested a structural model for the glasses, which was confirmed by the other physical properties measured. Dissert. Abstr.

N81-18196 State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
CATION BINDING AND CATALYSIS BY POLY(CROWN ETHERS) Ph.D. Thesis
Shailesh Chimanlal Shah 1979 94 p
Avail: Univ. Microfilms Order No. 8019082

Cation binding properties of polymers with crown ethers as pendent groups were studied by determining the conductance and viscosity of the polymer solutions in the presence of crown complexable cations. The conductance was shown to depend on the nature of the crown-cation complex and the charge density on the polymer chain. Stoichiometries of some of the crown-cation complexes were obtained in methyl ethyl ketone and acetone. The conductance data of alkali tetraphenylborate solutions in the presence of poly(vinylbenso 18-crown-6) (P18C6) indicate that the binding constants decrease in the order K(+) > Cs(+) > Na(+). The binding constants with poly(vinylbenzo 15-crown-5)

(P15C5) decrease in the order Cs(+) > K(+) > Na(+).
Dissert. Abstr.

N81-18197*# Utah Univ., Salt Lake City. Flammability Research Center.
FLAMMABILITY SCREENING TESTS OF RESINS Final Report
R. W. Arhart, D. G. Farrar, and B. M. Hughes Oct. 1979 135 p refs
(Contract NAS2-9950)
(NASA-CR-152312; UTEC-79-140) Avail: NTIS HC A07/MF A01 CSCL 11G

Selected flammability characteristics of glass cloth laminates of thermosetting resins are evaluated. A protocol for the evaluation of the flammability hazards presented by glass cloth laminates of thermosetting resins and the usefulness of that protocol with two laminates are presented. The glass laminates of an epoxy resin, M-751 are evaluated for: (1) determination of smoke generation from the laminates; (2) analysis of products of oxidative degradation of the laminates; (3) determination of minimum oxygen necessary to maintain flaming oxidation; (4) evaluation of toxicological hazards. S.F.

N81-18198*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RECENT DEVELOPMENTS IN POLYIMIDE ADHESIVES AT NASA-LANGLEY RESEARCH CENTER
Terry L. St.Clair Jan. 1981 14 p refs
(NASA-TM-81936) Avail: NTIS HC A02/MF A01 CSCL 11A

Adhesive development is directed towards elevated temperature applications (200-300 C). Because of thermal stability considerations, the most attractive adhesives for this temperature range are linear and addition polyimides. The linear polymide adhesive research encompassed basic structure-property relationships, solvent studies and formulations to meet various requirements. The most recent research in linear polyimide systems was in the development of thermoplastic systems in an effort to eliminate the undesirable evolution of water classically associated with the cure going through an amide-acid intermediate step in the cure process. Addition polyimide adhesive research was undertaken in order to avoid water evolution during cure. Basic structure-property relationships for these materials led to an adhesive which was used extensively for high temperature adhesive needs. Since addition systems are of a highly crosslinked nature, they are not as resistant to impact as their linear counterparts. In order to overcome this problem, research was done in the area of elastomer-toughening these polymers. S.F.

N81-18199*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CERAMIC AND COATING APPLICATIONS IN THE HOSTILE ENVIRONMENT OF A HIGH TEMPERATURE HYPERSONIC WIND TUNNEL
Richard L. Puster, John R. Karns, Peter Vasquez, and Warren C. Kelliher Jan. 1981 34 p refs
(NASA-TM-81931) Avail: NTIS HC A03/MF A01 CSCL 11I

A Mach 7, blowdown wind tunnel was used to investigate aerothermal structural phenomena on large to full scale high speed vehicle components. The high energy test medium, which provided a true temperature simulation of hypersonic flow at 24 to 40 km altitude, was generated by the combustion of methane with air at high pressures. Since the wind tunnel, as well as the models, must be protected from thremally induced damage, ceramics and coatings were used extensivley. Coatings were used both to protect various wind tunnel components and to improve the quality of the test stream. Planned modifications for the wind tunnel included more extensive use of ceramics in order to minimize the number of active cooling systems and thus minimize the inherent operational unreliability and cost that accompanies such systems. Use of nonintrusive data acquisition techniques, such as infrared radiometry, allowed more widespread use of ceramics for models to be tested in high energy wind tunnels. R.C.T.

N81-18200# SRI International Corp., Menlo Park, Calif.
HIGH TEMPERATURE OXIDATION AND MECHANICAL PROPERTIES OF SILICON NITRIDE Final Report, 1 Oct. 1976 - 30 Oct. 1980
D. D. Cubicciotti, K. H. Lau, D. J. Rowcliffe, and R. H. Lamoreaux 30 Nov. 1980 69 p refs
(Contract F44620-76-C-0116; AF Proj. 2306)
(AD-A094415; SRI-5522-4; AFOSR-81-0031TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

A summary is presented of the progress made during the four years of an investigation into the high-temperature oxidation and mechanical properties of hot-pressed silicon nitride. Progress during the fourth year of the program is emphasized. GRA

N81-18201# Goodrich (B. F.) Co., Akron, Ohio.
ALUMINIZED CODING STUDY FOR RETROFITTING IN-SERVICE SLIDE MATERIALS Final Report
R. J. Cole and G. S. Sims Nov. 1980 69 p ref
(Contract DOT-FA79NA-6065; FAA Proj. 161-350-320)
(AD-A094170; FAA-CT-81-151; BFG-80-31-023) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report describes the work to develop a thermal-resistant reflective coating for the retrofit of in-service slides and slide/rafts. The report includes the experimental evaluation of commercially available reflective coatings and paints, ingredient-modification experiments, methods of application, physical properties tests, and retrofit cost estimate. The end product of this study resulted in a new aluminum polyurethane coating, BF Goodrich coating KE7620, suitable for retrofit purposes. GRA

N81-18202# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
SMALL-ANGLE X-RAY DIFFRACTION STUDY OF THERMAL TRANSITION IN STYRENE-BUTADIENE BLOCK COPOLYMERS
Ryong-Joon Roe, M. Fishkis, and J. C. Chang 15 Jan. 1981 65 p refs Submitted for publication
(Contract N00014-77-C-0326)
(AD-A094531; TR-5) Avail: NTIS HC A04/MF A01 CSCL 07/4

The small-angle X-ray scattering (SAXS) technique is used to study the transition in styrene-butadiene block copolymers from a microdomain structure to a disordered homogeneous phase. The transition, occurring on raising the temperature, is reproducible and thermally reversible. The SAXS intensity pattern, exhibiting a main interdomain peak and a few secondary peaks at room temperature, shows a gradual decrease in intensity over a temperature range of more than 100 deg, but the position and the overall shape of the main peak remain unchanged. Analysis of the SAXS data shows that, with increasing temperature, the invariant and the length of inhomogeneity decrease, but the domain boundary thickness remains approximately constant. It is concluded that the disappearance of the microdomains proceeds by gradual intermixing of components into the opposite phases, with accompanying changes in the size of the microdomains, much in the same manner as would occur with coexisting phases of a binary liquid system. Even when the microdomains have finally disappeared and the mixture has become thermodynamically homogeneous, the SAXS pattern of diminished intensity persists, reflecting the presence of dynamic density inhomogeneity, as suggested in the theories by de Gennes and by Leibler. The similarity of our SAXS results with those obtainable with a supercooled mixture undergoing a spinodal decomposition is pointed out and its thermodynamic basis discussed. GRA

N81-18203# Northwestern Univ., Evanston, Ill.
TRANSFERENCE NUMBER MEASUREMENTS FOR THE POLYMER ELECTROLYTE POLY(ETHYLENE OXIDE), NaSCN Interim Technical Report
R. Dupon, D. H. Whitmore, and D. F. Shriver Jan. 1981 16 p refs
(Contract N00014-80-C-0532; NR Proj. 359-746)
(AD-A094039) Avail: NTIS HC A02/MF A01 CSCL 11/9

Fmf measurements have been determined in a Na/Hg amalgam concentration cell containing the solid electrolyte poly(ethylene oxide)NaSCN. These results in conjunction with measurements made with blocking electrodes of the frequency dependent conductivity, demonstrate that the main charge carrier is Na(-). GRA

N81-18204# Mound Lab., Miamisburg, Ohio.
CHARACTERIZATION OF FIBERGLASS-FILLED DIALLYL PHTHALATE PLASTIC MOLDING RESINS AND MOLDED PARTS
Ruth B. Whitaker, Jerome E. Glaub, Nicholas R. Bonekowski, and Phillip D. Gillham (Monsanto Co., St. Louis) 1 Dec. 1980 25 p refs
(Contract DE-AC04-76DP-00053)
(MLM-2766) Avail: NTIS HC A02/MF A01

Characterization of diallyl phthalate (DAP) molding resins was undertaken by differential scanning calorimetry (DSC) and by combined size exclusion chromatography (SEC)/low angle laser light scattering (LALLS) in order to better predict moldability and storage life limits. Completeness of cure of molded parts, before and after any post curing, was also determined by thermal anlaysis. Molecular weights and molecular weight distributions of the DAP molding resins by SEC/LALLS indicated that the better molding resins have lower M sub w/M sub n ratios. Association effects were observed, which could not be overcome by solvent modification alone. Determination of DAP molding resin heats of reaction by DSC indicated a linear relation between DELTA H sub R and weight percent filler for the good molding resins. DSC analyses of molded DAP parts showed that 95 percent cure was achieved in some as molded parts, with a post cure temperature of 165 C being required to complete the cure to 100 percent. Thickness of the parts was factor, with the thicker parts being 100 percent cured as molded. The glass transition temperature (T sub g) of the molded parts increased as cure was completed, to approx. 160 to 165 C maximum. DOE

N81-18205# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
SLIDING MECHANISMS FOR GRAIN BOUNDARIES CONTAINING PRE-EXISTING CAVITIES IN Al2O3-SiO2 CERAMICS Ph.D. Thesis
Amar Pal Singh Rana Nov. 1980 107 p refs
(Contract W-7405-eng-48)
(LBL-11486) Avail: NTIS HC A06/MF A01

This study examines models of grain boundary sliding when cavities are present at grain boundaries in Al2O3-SiO2 ceramics using the internal friction technique. Two types of microstructure, and the concomitant modes of grain boundary sliding, were distinguished in this study. The first microstructure consisted of grains encompassed by an amorphous phase. The relaxation time has been calculated when grain boundaries have preexisting cavities. Sliding in single phase microstructure is accommodated by boundary diffusion and by viscous deformation in materials with a glassy grain boundary phase. Cavities only had a small contribution to grain boundary sliding. At relatively high temperatures, internal friction rises exponentially to very large values. This phenomenon is mainfest in polycrystalline samples as an upturn in the internal friction on the high temperature side of the peak. A transient analysis pertinent to the high temperature background demonstrated the significance of a dimensionless parameter, which was a function of frequency, grain size, elastic modulus and grain boundary diffusivity. DOE

N81-18206 Tennessee Univ., Knoxville.
INTERPRETATION OF THE RHEOLOGICAL PROPERTIES OF CARBON BLACK REINFORCED POLYMER MELTS Ph.D. Thesis
Vincent Michael Lobe 1980 170 p
Avail: Univ. Microfilms Order No. 8104604

Stress relaxation and dynamic experiments characterized the small strain behavior while steady state shear viscosity, normal stresses and elongational flow experiments described the large strain response. Extrudate swell was also measured. Highly filled systems exhibited yield values. This is seen in the dynamic experiments and in the shear and elongational viscosities. Viscosity does not level off at finite values with decreasing deformation rate but continues to increase approximately inversely proportional to the deformation rate. This corresponds to yield values of order 500,000 dynes/sq cm. The storage modulus also does not tend to zero at low frequencies. The dynamic properties and stress relaxation results suggest high material memories for the highly filled systems. The extrudate swell values are small, however, and these systems exhibited very little delayed recovery. The implications of these experimental results are interpreted in terms of a generalized Schwedoff body, a single integral constitutive model with a yield value. Dissert. Abstr.

N81-18207 California Univ., Los Angeles.
THEORETICAL INVESTIGATIONS OF HELIX-COIL TRANSITIONS AND MESOMORPHIC ORDERS IN POLYMERS
Young Hwa Kim 1980 110 p
Avail: Univ. Microfilms Order No. 8104009

Three aspects of polypeptide solution mesophases are discussed. The first problem is that of exclude volume effects on lyotropic nematic behavior; the second is the dilute solution behavior of polypeptide chains under a longitudinal velocity gradient; the third is a theoretical model for the cholesteric phase of polypeptide solutions. In the introduction general aspects of heliogenic polymers, alpha-helix conformation, the helix coil transitions and the cholesteric mesophase of polypeptide solutions are discussed. A theory is presented to describe a cooperative transition induced by excluded volume effects. The theory predicts that excluded volume effects may lead to a first order phase transition in which polymers in solution make a transition from a nearly coiled to a nearly rigid conformation accompanied by a simultaneous development of long range nematic type liquid crystalline orientational order. The phase boundaries between nematic and isotropic phases are calculated as a function of polymer concentration. Dissert Abstr.

N81-18208 Northwestern Univ., Evanston, Ill.
THE EFFECT OF MACROMOLECULAR CONFORMATION ON ADSORPTION AND IONIC INTERACTIONS OF POLYELECTROLYTES Ph.D. Thesis
Daniel James Belton 1980 231 p
Avail: Univ. Microfilms Order No. 8104690

The adsorption behavior of polyelectrolytes at an ionic interface, the kinetics of ionic interactions in aqueous solutions, and the formation of supermolecular structure define the ability of these materials to function as adhesives. The present investigation utilized Fourier transform infrared, spectroscopy coupled with the technique of attenuated total reflectance, and small angle X-ray scattering to characterize the adsorption behavior, ionic interactions, and supermolecular structure of poly(acrylic acid). The conversion of carboxylic acid groups to carboxylate ions by a basic ion leachable glass was monitored and the following variables examined: initial reaction rate; overall reaction rate; and the ultimate degree of conversion. The initial rate of reaction was observed to increase with both increasing degree of ionization and salt content. Dissert. Abstr.

N81-18209 Massachusetts Univ., Amherst.
SYNTHESIS AND PROPERTIES OF ELECTRICALLY CONDUCTING POLYMERS Ph.D. Thesis
Gary Edmund Wnek 1980 305 p
Avail: Univ. Microfilms Order No. 8101411

Several approaches in the context of applied polymer science to the characterization and synthetic chemical modification of polyacetylene are explored. Laboratory techniques concerning the purification of materials, doping procedures and the preparation of polyacetylene films are described. The polymerization mechanism and possible structures of catalyst species in the Ti(OBu)4/Et3Al system are discussed. Paramagnetism increases upon AsF5 doping: the opposite is observed in the case of iodine doping. The phenomenon of microwave heating of doped samples as a function of power is also discussed. Copolymerization is shown to be an effective method for the modification of chemical, physical and electrical properties of (CH)x. The synthesis of acetylene/methyl acetylene copolymer films is described.
Dissert. Abstr.

N81-18210 Tennessee Univ., Knoxville.
PHOTOINITIATED CATIONIC POLYMERIZATION Ph.D. Thesis
Timothy Allen Tufts 1980 120 p
Avail: Univ Microfilms Order No. 8104628

Several compounds were investigated for their effectiveness in the photoinitiated cationic polymerization of cyclohexene oxide. Two types of compounds were studied; those with a-methoxyphenyl substituent and several vinyl halides. The effects of initiator concentration, and irradiation time on isolated polymer yield and molecular weight were studied. The p-methoxyphenyl

compounds were found to be ineffective as photoinitiators, giving very low polymer yields in the dark as well as when irradiated. The most effective compound investigated for use as a photoinitiator was found to be (E)-1,2-dibromo-1-(4-methoxphenyl)-2-phenylethene. It was also found to form films when a mixture of monofunctional and difunctional epoxides was used.
Dissert. Abstr.

N81-18010*# Boeing Aerospace Co., Seattle, Wash.
EVALUATION OF HIGH-TEMPERATURE STRUCTURAL ADHESIVES FOR EXTENDED SERVICE
Carl L. Hendricks and Sylvester G. Hill *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2, Mar. 1980 p 675-686 (For primary document see N81-18005 09-01)
(Contract NAS1-15605)
Avail: NTIS HC A18/MF A01 CSCL 11A

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-18211 Stevens Inst. of Tech., Hoboken, N. J.
KINETICS OF DONOR-SOLVENT LIQUEFACTION OF COAL IN NONISOTHERMAL EXPERIMENTS Ph.D. Thesis
Govindan Mohan 1980 203 p
Avail: Univ. Microfilms Order No. 8100856

Coal was liquefied in a batch reactor under nonisothermal conditions from 330 to 450 C using tetrain as a hydrogen donor solvent at total pressures up to 70 atm and reaction times from 5 to 60 minutes. A separation scheme was developed using liquid solid chromatography on alumina to separate the liquefied products into mixtures of classes of compounds referred to as aromatics, ethers, nitrogens, hydroxyls and multifunctionals. The chemical identities of these classes of compounds were determined by infrared and nuclear magnetic resonance spectroscopy. Using these classes of compounds several kinetic models were tested to fit experimental concentration time profiles using a nonisothermal, nonlinear parameter estimation technique. The multifunctional compounds were considered as reaction intermediate which then decomposed reversibly into aromatics, ethers, nitrogens and hydroxyls. It was found that this kinetic model predicts concentration time profiles satisfactorily. Dissert. Abstr.

N81-18212*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. VOLUME 1: EXECUTIVE SUMMARY Final Report
31 Dec. 1980 56 p 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161653; BDM/H-80-800-TR-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21D

Feasibility analyses and systems engineering studies for a 20,000 tons per day medium Btu (MBG) coal gasification plant to be built by TVA in Northern Alabama were conducted. Major objectives were as follows: (1) provide design and cost data to support the selection of a gasifier technology and other major plant design parameters, (2) provide design and cost data to support alternate product evaluation, (3) prepare a technology development plan to address areas of high technical risk, and (4) develop schedules, PERT charts, and a work breakdown structure to aid in preliminary project planning. Volume one contains a summary of gasification system characterizations. Five gasification technologies were selected for evaluation: Koppers-Totzek, Texaco, Lurgi Dry Ash, Slagging Lurgi, and Babcock and Wilcox. A summary of the trade studies and cost sensitivity analysis is included. E.D.K.

N81-18213*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS, VOLUME 2 Final Report
31 Dec. 1980 311 p 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161654; BDM/H-80-800-TR-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 21D

The major design related features of each generic plant system were characterized in a catalog. Based on the catalog and requirements data, approximately 17 designs and cost estimates were developed for MBG and alternate products. A series of generic trade studies was conducted to support all of the design studies. A set of cost and programmatic analyses were conducted to supplement the designs. The cost methodology employed for the design and sensitivity studies was documented and implemented in a computer program. Plant design and construction schedules were developed for the K-T, Texaco, and B&W MBG plant designs. A generic work breakdown structure was prepared, based on the K-T design, to coincide with TVA's planned management approach. An extensive set of cost sensitivity analyses was completed for K-T, Texaco, and B&W design. Product price competitiveness was evaluated for MBG and the alternate products. A draft management policy and procedures manual was evaluated. A supporting technology development plan was developed to address high technology risk issues. The issues were identified and ranked in terms of importance and tractability, and a plan developed for obtaining data or developing technology required to mitigate the risk. E.D.K.

N81-18214*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. APPENDIX A: COAL GASIFICATION CATALOG Final Report
31 Dec. 1980 221 p refs 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161655; BDM/H-80-800-TR-App-A) Avail: NTIS HC A10/MF A01 CSCL 21D

The scope of work in preparing the Coal Gasification Data Catalog included the following subtasks: (1) candidate system subsystem definition, (2) raw materials analysis, (3) market analysis for by-products, (4) alternate products analysis, (5) preliminary integrated facility requirements. Definition of candidate systems/subsystems includes the identity of and alternates for each process unit, raw material requirements, and the cost and design drivers for each process design. E.D.K.

N81-18215*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. APPENDIX B: MEDIUM Btu GAS DESIGN Final Report
31 Dec. 1980 275 p 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161656; BDM/H-80-800-TR-App-B) Avail: NTIS HC A12/MF A01 CSCL 21D

A four module, 20,000 TPD, based on KT coal gasification technology was designed. The plant processes Kentucky No. 9 coal with provisions for up to five percent North Alabama coal. Medium Btu gas with heat content of 305 Btu/SCF and not more than 200 ppm sulfur is the primary plant product. Sulfur is recovered for scale as prilled sulfur. Ash disposal is on site. The plant is designed for zero water discharge. Trade studies provided the basis for not using boiler produced steam to drive prime movers. Thus process derived steam in excess of process requirements in superheated for power use in prime movers. Electricity from the TVA grid is used to supply the balance of the plant prime mover power requirements. A study of the effect of mine mouth coal cleaning showed that coal cleaning is not an economically preferred route. The design procedure involved defining available processes to meet the requirements of each system, technical/economic trade studies to select the preferred processes, and engineering design and flow sheet development for each module. Cost studies assumed a staggered construction schedule for the four modules beginning spring 1981 and a 90% on stream factor. E.D.K.

N81-18216*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. APPENDIX C: ALTERNATE PRODUCT FACILITY DESIGNS Final Report
31 Dec. 1980 221 p refs 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161657; BDM/H-80-800-TR-APP-C) Avail: NTIS HC A10/MF A01 CSCL 21D

The study of the production of methane, methanol, gasoline, and hydrogen by an add-on facility to a Koppers-Totzek based MBG plant is presented. Applications to a Texaco facility are inferred by evaluation of delta effects from the K-T cases. The production of methane from an add-on facility to a Lurgi based MBG plant and the co-production of methane and methanol from a Lurgi based system is studied. Studies are included of the production of methane from up to 50 percent of the MBG produced in an integrated K-T based plant and the production of methane from up to 50 percent of the MBG produced from an integrated plant in which module 1 is based on K-T technology and modules 2, 3, and 4 are based on Texaco technology. E.D.K.

N81-18217*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. APPENDIX D: COST AND ECONOMIC STUDIES Final Report
31 Dec. 1980 636 p 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161658; BDM/H-80-800-TR-App-D) Avail: NTIS HC A99/MF A01 CSCL 21D

The detailed cost estimate documentation for the designs prepared in this study are presented. The include: (1) Koppers-Totzek, (2) Texaco (3) Babcock and Wilcox, (4) BGC-Lurgi, and (5) Lurgi. The alternate product cost estimates include: (1) Koppers-Totzek and Texaco single product facilities (methane, methanol, gasoline, hydrogen), (2) Koppers-Totzek SNG and MBG, (3) Koppers-Totzek and Texaco SNG and MBG, and (4) Lurgi-methane and Lurgi-methane and methanol. E.D.K.

N81-18218*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. APPENDIX E: COST ESTIMATION AND ECONOMIC EVALUATION METHODOLOGY Final Report
31 Dec. 1980 71 p refs 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161659; BDM/H-80-800-TR-App-E) Avail: NTIS HC A04/MF A01 CSCL 21D

The cost estimation and economic evaluation methodologies presented are consistent with industry practice for assessing capital investment requirements and operating costs of coal conversion systems. All values stated are based on January, 1980 dollars with appropriate recognition of the time value of money. Evaluation of project economic feasibility can be considered a two step process (subject to considerable refinement). First, the costs of the project must be quantified and second, the price at which the product can be manufacturd must be determined. These two major categories are discussed. The summary of methodology is divided into five parts: (1) systems costs, (2) instant plant costs, (3) annual operating costs, (4) escalation and discounting process, and (5) product pricing. E.D.K.

N81-18219*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. APPENDIX F: CRITICAL TECHNOLOGY ITEMS/ISSUES Final Report
31 Dec. 1980 48 p refs 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161660; BDM/H-80-800-TR-App-F) Avail: NTIS HC A17/MF A01 CSCL 21D

Critical technology items and issues are defined in which there is a need for developmental research in order to assure technical and economic success for the state of the art of coal gasification in the United States. Technology development needs for the main processing units and the supporting units are discussed. While development needs are shown for a large number of systems, the most critical areas are associated with the gasifier itself and those systems which either feed the gasifier or directly receive products form the gasifier. E.D.K.

N81-18220*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. APPENDIX G: COMMERCIAL DESIGN AND TECHNOLOGY EVALUATION Final Report
31 Dec. 1980 29 p 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161661; BDM/H-80-800-TR-App-G) Avail: NTIS HC A03/MF A01 CSCL 21D

A technology evaluation of five coal gasifier systems (Koppers-Totzek, Texaco, Babcock and Wilcox, Lurgi and BGC/Lurgi) and procedures and criteria for evaluating competitive commercial coal gasification designs is presented. The technology evaluation is based upon the plant designs and cost estimates developed by the BDM-Mittelhauser team. E.D.K.

N81-18221*# BDM Corp., Huntsville, Ala.
COAL GASIFICATION SYSTEMS ENGINEERING AND ANALYSIS. APPENDIX H: WORK BREAKDOWN STRUCTURE Final Report
31 Dec. 1980 142 p 10 Vol.
(Contract NAS8-33824)
(NASA-CR-161662; BDM/H-80-800-TR-App-H) Avail: NTIS HC A17/MF A01 CSCL 21D

A work breakdown structure (WBS) is presented which encompasses the multiple facets (hardware, software, services, and other tasks) of the coal gasification program. The WBS is shown to provide the basis for the following: management and control; cost estimating; budgeting and reporting; scheduling activities; organizational structuring; specification tree generation; weight allocation and control; procurement and contracting activities; and serves as a tool for program evaluation. R.C.T.

N81-18222# Pennsylvania State Univ., University Park.
UTILIZATION OF ALTERNATE FUELS IN DIESEL ENGINES Final Report
Samuel S. Lestz Sep. 1980 52 p refs
(Contract DE-AS02-77CS-54530)
(COO-4530-1; CAES-577-80) Avail: NTIS HC A04/MF A01

Experiments were designed and test equipment set up for the purpose of evaluating the use of methanol as a fumigant for light duty diesel engine service. The major experimental results were obtained from a multicylinder automotive diesel engine. Chemical and physical properties of methanol and methanol-air mixtures are measured. A 5.7 liter V-8 diesel engine was fumigated with methanol in amounts up to 40 percent of the fuel energy. The effect of methanol fumigation on fuel efficiency, smoke, nitric oxide emission, and the occurrence of severe knock were determined. DOE

N81-18223# Royal Inst. of Tech., Stockholm (Sweden).
GASIFICATION AND DESULFURIZATION OF COAL BY INJECTION INTO MOLTEN METALS
Anders Sundstroem May 1980 46 p refs
(STU-78-4560) Avail: NTIS HC A03/MF A01

The desulfurization and gasification of coal was investigated on 10 resp. 20 kg scale by injecting coal powder with and without oxygen into inductively heated copper melts at approximately 1300 C. The variable parameters were the depth and temperature of the bath, the flow of oxygen, particle size, and the contents of sulfur of the bath. The results show that Zn, Mn, and Pb are theoretically unsuitable as gasification agents, whereas the potential of Ni is considerably greater. Copper seems to be more suitable for the desulfurization of coal than for the gasification especially owing to big losses of coal dust during gasification. These are probably due to deficient solubility of coal; the gas which was produced at gasification had very divergent CO/CO2 ratios and very low sulfur containing gases, less than 175 ppM. There is a slight tendency of particle size dependent production of CO. This dependence could not be confirmed when the coal powder was desulfurized. DOE

N81-18224# Department of Energy, Washington, D. C.
GENERATOR GAS OPERATION OF MOTOR VEHICLES
1981 25 p Transl. into ENGLISH from Swedish article
(DOE-TR-219) Avail: NTIS HC A02/MF A01

The Swedish history, development, and status of motor vehicles which operate on generator gas produced from burning wood chips are discussed. These vehicles, e.g., passenger car, trucks, buses, tractors, are modified to accommodate the attached generator gas unit and to permit combustion of the generator gas in the vehicle engine. Data are included on fuel consumption for specific types of wood and for types of vehicles, the design and operation of generator gas equipment, and safety recommendations. DOE

N81-18225# California Univ., Livermore.
SOLAR COAL GASIFICATION: PLANT DESIGN AND ECONOMICS
William R. Aiman, Charles B. Thorsness, and David W. Gregg 12 Nov. 1980 50 p refs Presented at the 73rd Ann. Meeting of the AICE, Chicago, 16-20 Nov. 1980
(Contract W-7405-eng-48)
(UCRL-84610; CONF-801104-6) Avail: NTIS HC A03/MF A01

A plant was layed out and analyzed with the aid of a code that calculates process flows and plant economics. This plant is the simplest, most straightforward plant and thus the most appropriate for initial analysis. Solar energy is focused directly on the reacting coal. The process analysis shows that 40% more product can be produced from a given amount of coal and that the fraction of the solar energy that can be converted into usable energy is greater than that for any other method with the exception of conversion to simple thermal energy. The economic analysis shows that for a gasification plant that produces a given amount of product per year, the capital costs are much higher but the operating costs are much lower. These cost differences reflect the 8 hr per day operation and the lower coal consumption for the SCG plant. Product costs were derived as a function of coal cost. DOE

N81-18226# UOP, Inc., Des Plaines, Ill.
UPGRADING OF COAL LIQUIDS: UPGRADING DISTILLATES FROM COAL LIQUEFACTION Annual Report, 31 Jan. 1979 - 31 Jan. 1980
A. J. deRossett, F. J. Riedl, L. Hilfman, and R. W. Johnson Oct. 1980 96 p refs
(Contracts DE-AC01-77ET-10131; EF-77-C-01-2566)
(FE-2566-42) Avail: NTIS HC A05/MF A01

Coal derived naphthas from the H-Coal and Exxon donor solvent (EDS) and SRC-2 processes were hydrotreated and reformed in research pilot plants to 100 research octane number (RON) gasoline. Conditions for hydrotreating were relatively severe compared to those required to treat a Middle East naphtha. Reforming proceeded at relatively mild conditions. Hydrogen yield was greatly in excess of the amount required for hydrotreating. The 400 F(+) distillates from the H-Coal and EDS processes were converted in research pilot plants by hydrotreating hydrocracking and fluid catalytic cracking (FCC). Hydrotreating alone fave high yields of environmentally acceptable No. 2 fuel oil. Hydrocracking to gasoline proceeded at operating conditions somewhat more severe than required for the Middle East gas oil. Hydrogen consumption was high. It was found that a portion of the hydrogen can be recovered by reforming the hydrocracked naphtha to 100 RON gasoline. Additional hydrogen can potentially be recouped by steam reforming light gases. DOE

N81-18227# Purdue Univ., Lafayette, Ind. School of Chemical Engineering.
PHASE EQUILIBRIUM IN COAL LIQUEFACTION PROCESSES Final Report
K. C. Chao, H. M. Lin, G. D. Nageshwar, H. Y. Kim, J. L. Oliphant, H. M. Sebastian, and J. J. Simnick Oct. 1980 182 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 367-2)
(EPRI-AP-1593) Avail: NTIS HC A09/MF A01

Gas liquid equilibria were determined in simulation of coal liquefaction process conditions in mixtures of light gases + heavy hydrocarbons (polynuclear aromatics, N, S, and O containing aromatics, some paraffins, and naphthenes). The mixture systems investigated were: 32 binary mixture systems of a light gas (hydrogen, methane, or carbon dioxide) + a heavy hydrocarbon; 2 ternary mixture systems of hydrogen + two heavy hydrocarbons, 2 ternary mixture systems of hydrogen + methane + a heavy hydrocarbon; 5 complex mixture systems of hydrogen + a coal oil fraction; and 4 complex mixture systems of methane + a coal oil fraction. Equilibrium data were determined at pressures up to 250 atm and temperatures up to 460(0) C which was substantially above the upper limit of previously reported data. A flow apparatus of special design made possible the attainment of the elevated temperatures at high pressures. Vapor pressures were determined for eight hydrocarbons at superatmospheric pressures using the same apparatus. A solubility parameter based correlation was developed for the solubility of hydrogen. The hydrogen, methane, and carbon dioxide data was analyzed and correlated with various degrees of success with the Soave equation of state, and Boublik-Alder-Chen-Kreglewski equation of state. DOE

N81-18228# Oak Ridge National Lab., Tenn.
INDIRECT CONVERSION OF COAL TO METHANOL AND GASOLINE: PRODUCT PRICE VS PRODUCT SLATE
R. M. Wham, D. J. McCracken (Fluor Engineers and Constructors, Inc., Houston, Tex.), and R. C. Forrester, III (Fluor Engineers and Constructors, Inc., Irvine, Calif.) 1980 23 p refs Presented at Coal Technol. '80, 3rd Intern. Coal Utilization Exhibition and Conf., Houston, Tex., 18-20 Nov. 1980
(Contract W-7405-eng-26)
(CONF-801142-3) Avail: NTIS HC A02/MF A01

The technical feasibility, economic competitiveness, and environmental acceptability of selected indirect coal liquefaction processes are described. Particular emphasis is placed on production of methanol as a principal product or methanol production for conversion to gasoline. Potential uses for the methanol are combustion in peaking type turbines or blending with gasoline to yield motor fuel. Conversion of methanol to gasoline is accomplished through the use of the Mobil methanol to gasoline (MTG) process. The conceptual designs are described for the indirect conversion of a Western subbituminous coal to either methanol or gasoline. The bases for the conceptual designs are given. The case designations are: methanol production for turbine grade fuel; methanol production for gasoline blending; gasoline production with coproduction of SNG; and gasoline production maximized. DOE

N81-18229# Texas Technological Univ., Lubbock. Dept. of Chemical Engineering.
KINETIC INVESTIGATION OF WOOD PYROLYSIS
Franz Thurner, Uzi Mann, and Steven R. Beck Jun. 1980 80 p refs
(Contract DE-AS04-76ET-20041)
(DOE/ET-20041/T2) Avail: NTIS HC A05/MF A01

The kinetics of the primary reactions of wood pyrolysis are investigated. An experimental method was developed to measure the rate of gas, tar, and char production while taking into account the temperature variations during the wood heating up. It facilitated the collection of gas, tar and residue (unreacted wood and char) as well as accurate measurement of the temperature inside the wood sample. Expressions relating the kinetic parameters to the measured variables were derived. The pyrolysis kinetics was investigated in the range of 300 to 400 C at atmospheric pressure and under nitrogen atmosphere. Reaction temperature and mass fractions of gas, tar, and residue were measured as a function of time. Assuming first order reactions, the kinetic parameters were determined using differential method. The measured activation energies of wood pyrolysis to gas, tar, and char were 88.6, 112.7, and 106.5 kJ/mole, respectively. These kinetic data were then used to predict the yield of the various pyrolysis products. It was found that the best prediction was obtained when an integral mean temperature obtained from the temperature time curve was used as reaction temperature. The pyrolysis products were analyzed to investigate the influence of the pyrolysis conditions on the composition. DOE

N81-18230# Department of Energy, Bartlesville, Okla. Energy Technology Center.
FLEET TRAILS USING METHANOL/GASOLINE BLENDS
Ken R. Stamper 1980 10 p refs Presented at 4th Intern. Symp. on Alcohol Fuels Technol., Sao Paulo, Brazil, 5 Oct. 1980
(CONF-801030-4) Avail: NTIS HC A02/MF A01

Seven current production automobiles were used in a fleet study to determine the long term effects and end use influences of using 10% methanol/90% gasoline blends as automotive fuels. The vehicles were operated over a course designed to accumulate mileage at a rate and duty cycle similar to automobiles used by the private sector in the US. Vehicle tests were run at each 5000 mile accumulation interval to determine the fuel economy and the mass of pollutant emissions generated by the vehicles operating on the 10% methanol blend and to establish a basis for comparison on an unleaded, low octane Indolene. These data showed an average reduction in carbon monoxide emissions

associated with the use of the 10% methanol blend. At the end of 50,000 miles of operation on the blend, the engine and fuel handling systems in four of the vehicles were disassembled for inspection and rating to identify any significant wear or materials incompatibility problems associated with long term operation on the methanol blend. Other signficant observations as well as the results are reported. DOE

N81-18231# Chevron Research Co., Richmond, Calif.
REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES Quarterly Report, Apr. - Jun. 1980
R. F. Sullivan and D. J. ORear Jul. 1980 27 p
(Contracts DE-AC01-76ET-10532; EF-76-C-01-2315)
(FE-2315-55) Avail: NTIS HC A03/MF A01

The relationship between the measured cetane number and the calculated cetane index (ASTM D 976-66) was examined for 11 coal derived diesel fuels. The cetane index is consistently less than the measured cetane number. Octyl nitrate was shown to be an effective cetane number improver for coal derived diesel fuels. For a 40.2 cetane number base fuel which contained 2.4 vol % aromatics, 0.1 vol % octyl nitrate improved the cetane number by 3.5 and 0.3 vol % octyl nitrate improved the cetane number by 8.1. Aromatics were shown to inhibit the octyl nitrate as a cetane improver. In a short test, the feasibility of refining Wyodak H-Coal cyncrude to a No. 2 fuel at low pressures was examined. Product made at 1000 psig total pressure (900 psia hydrogen) and 50% aromatics was stable. Products made at 500 psig total pressure (about 400 psia hydrogen) was unstable. Denitrified Wyodah H-Coal syncrude was hydrocracked in an extinction recycle pilot plant. The yields from this plant are very similar to the yields obtained from the denitrified Illinois H-Coal on SRC-2 syncrudes. This task will complete our experimental program on the Wyodak H-Coal syncrudes. DOE

N81-18232# Oak Ridge National Lab., Tenn. Office of Coal Research.
HYDROCARBONIZATION RESEARCH: COMPLETION REPORT
E. L. Youngblood, H. D. Cochran, Jr., P. R. Westmoreland, C. H. Brown, Jr., G. E. Oswald, and R. E. Barker Jan. 1981 134 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6693) Avail: NTIS HC A07/MF A01

Hydrocarbonization is a relatively simple process used for producing oil, substitute natural gas, and char by heating coal under a hydrogen rich atmosphere. This report describes studies that were performed in a bench scale hydrocarbonization system at Oak Ridge National laboratory (ORNL) during the period 1975 to 1978. The results of mock up studies, coal metering valve and flowmeter development, and supporting work in an atmospheric hydrocarbonization system are also described. Oil, gas, and char yields were determined by hydrocarbonization of coal in a 0.1 m diam. fluidized bed reactor operated at a pressure of 2170 kPa and at temperatures ranging from 694 to 854 K. The nominal coal feed rate was 4.5 kg/h. Wyodak subbituminous coal was used for most of the experiments. A maximum oil yield of approximately 21% based on moisture and ash free (maf) coal was achieved in the temperature range of 810 to 840 K. Recirculating fluidized bed, uniformly fluidized bed, and rapid hydropyrolysis reactors were used. DOE

N81-18233# Oak Ridge National Lab., Tenn.
FUEL ALCOHOL EXTRACTION TECHNOLOGY COMMERCIALIZATION CONFERENCE
A. L. Compere, W. L. Griffith, and J. M. Googin 2 Dec. 1980 30 p refs Presented at Fuel Alcohol Extraction (FUALEX) Method of Neutral Solvents Extraction Technol. Commercialization Conf., Oak Ridge, Tenn., 2 Dec. 1980
(Contract W-7405-eng-26)
(CONF-801212) Avail: NTIS HC A03/MF A01

The fualex, or fuel alcohol extraction process, uses a combination of hydrocarbon and surfactant to remove neutral solvents, such as butanol, ethanol, isopropanol, and acetone, from aqueous solution. The hydrocarbon extractants used may be fuels such as gasoline, furnace oil, and diesel fuel. Surfactant concentrations ranging from 1 to 10 g/liter and hydrocarbon ranging from 0.01 to 1 liter per liter aqueous alcohols solution were investigated. The fualex process was tested on solutions which contain 5 percent total neutral solvents, since this is near maximum for the fermentation product stream. The neutral solvents are removed in the form of an emulsion which is white to light bluish in the visible range. The emulsion has potential for direct use in fuels or as an intermediate for obtaining purified solvents. DOE

N81-18234# TRW Systems Group, McLean, Va.
ENERGY BALANCES IN THE PRODUCTION AND END-USE OF METHANOL DERIVED FROM COAL
10 Dec. 1980 63 p refs
(Contract DE-AC01-79PE-70151)
(DOE/PE-70151/T4) Avail: NTIS HC A04/MF A01

Petroleum gain (petroleum only); net premium fuel gain (natural gas and petroleum); and net energy gain (includes all fuels; does not include free energy from Sun). The base case selected for evaluation was an energy efficient coal to methanol plant located in Montana/Wyoming and using the Lurgi conversion process. The following variations of the base coal methanol case are also analyzed: gasoline from coal with methanol as an intermediate step; and methanol from coal. Computations are made for the product methanol as a replacement for unleaded gasoline in a conventional spark ignition engine and as a chemical feedstock. Regarding mileage of methanol/gasoline compared to that of regular unleaded gasoline: mileage of the two fuels equal; mileage 4 percent better with gasohol; and mileage 4 percent worse with gasohol. DOE

N81-18235# Systems Science and Software, La Jolla, Calif.
COMPUTER MODELING OF COAL GASIFICATION REACTORS, YEAR 4 Annual Report, Oct. 1978 - Sep. 1979
T. R. Blake, D. H. Brownell, Jr., P. J. Chen, J. L. Cook, and G. P. Schneyer Mar. 1980 62 p refs
(Contract DE-AC21-76ET-10242)
(FE-1770-66; SSS-R-80-4416) Avail: NTIS HC A04/MF A01

The application of the fluidized bed computer model to specific gasifier systems was investigated. These simulations included jet penetration of bubble formation, solids mixing and product gas composition for a six-inch diameter bench scale reactor, and cold flow predictions of jet penetration and solids recirculation in two agglomerating combustor/gasifier reactors. The fluidized bed coal gasifier computer model was designed to provide a description of the hydrodynamic mixing and coupled chemistry within the reactor. A full description of the model is presented. DOE

N81-18236# United States Steel Corp., Monroeville, Pa.
USE OF COAL INJECTION AND OXYGEN IN A BLAST FURNACE TO PRODUCE FUEL GAS Final Report
Dec. 1980 37 p refs
(Contract DE-AC07-76ID-01570)
(IDO-10089) Avail: NTIS HC A03/MF A01

The feasibility of operating a blast furnace with coal injection and oxygen to produce fuel gas was evaluated. Probable operating conditions were based on United States Steel Corporation's experience with coal injection on an experimental blast furnace. It was found that the cost of the gas produced would, as expected, be sensitive to the costs of coal, coke, and oxygen used and also to the capability of the process to burn coal instead of coke. To be economically viable, the medium Btu produced [270 Btu per standard cubic foot (Btu/scf)] from coal, coke, and oxygen at $30 per ton ($/T), $100/T, and $48.60/T, respectively, would have to have a selling price between $6.74 per million Btu ($/MMBtu) and $7.38/MMBtu depending on the coal-to-coke ratio assumed to be achieved in the process. Because these selling prices are considerably higher than current costs for natural gas or fuel oil, it would appear that the operation of a blast furnace as a fuel gas producer would not be economically viable at this time. DOE

N81-18237# Department of Energy, Bartlesville, Okla. Bartlesville Energy Technology Center.
COMPARISONS OF GASOHOL AND GASOLINE IN LABORATORY AND FIELD TRIALS
J. R. Allsup and M. D. Gurney 18 Dec. 1980 7 p refs Presented at the 4th Intern. Symp. on Alc. Fuels Technol., Sao

Paulo, Brazil, 5-8 Oct. 1980
(CONF-801030-3) Avail: NTIS HC A02/MF A01

An effort was made to obtain comparative field experience with gasohol and with gasoline used in controlled tests with units of a commercial service fleet. A total of 110 vehicles were involved with half of the units operated using a control gasoline and the other half operated using gasohol. At an appropriate point in the tests, fuels were switched so that both gasohol and gasoline related data were obtained from all individual test units. Vehicle operators observed and recorded information from the vehicles during use in normal field service. Vehicle drivers rated driveability and recorded the nature and circumstances of vehicle malfunction. Service records provided information on fuel economy and on fuel system problems. Emissions and fuel economy data were obtained using a chassis dynamometer to run the prescribed test routines. Results in comparing experience between using gasohol and using gasoline showed, on the average, regulated emissions to have been lower for vehicles fueled with gasohol. Other significant results are obtained. R.C.T.

N81-18238# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
COAL HYDROGASIFICATION PROCESS DEVELOPMENT. VOLUME 1: COAL STUDIES Annual Technical Progress Report
L. P. Combs, S. K. Ubhayakar, L. S. Breese, D. R. Kahn, and W. T. Lee 20 Oct. 1980 221 p refs
(Contracts DE-AC01-78ET-10328; ET-78-C-01-3125)
(FE-3125-24-Vol-1; ATPR-2-GFY-80) Avail: NTIS HC A10/MF A01

Testing was concluded in a short-test-duration, engineering-scale, hydrogasification test facility. Test results established a data base for other program tasks. Correlation of the data, using nonlinear multiple regression techniques, against a set of phenomenological hydropyrolysis reactions, leads to a powerful analytical predictive tool. The design was completed and construction started on a 2/4-TPH integrated process development unit capable of continuous operation for up to 30 days. DOE

N81-18239# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
COAL HYDROGASIFICATION PROCESS DEVELOPMENT. VOLUME 2: PEAT STUDIES Annual Technical Progress Report
K. M. Sprouse and J. K. Rosemary 20 Oct. 1980 151 p refs
(Contract DE-AC01-78ET-10328)
(FE-3125-24-Vol-2; ATPR-2-GFY-80) Avail: NTIS HC A08/MF A01

The effects of peat hydrogasification in an entrained flow reactor are discussed three phases: peat dense-phase feed system flow studies; hydrogasification entrained flow reactor testing; and preliminary peat process economic evaluations. The peat dense-phase feeding studies included low pressure (below 150 psig) testing at nominal solid peat flow rates of 1 ton/hr and analytical modeling efforts. The hydrogasification reactor testing was performed at peat flow rates of over 1000 lb/hr and reactor temperatures to 1900(0) F in hydrogen atmospheres from 500 to 1000 psig. A simple analytical kinetic model was developed to predict total carbon conversion as a function of reactor operating variables. DOE

N81-18240# Exxon Research and Engineering Co., Florham Park, N.J.
EDS COAL LIQUEFACTION PROCESS DEVELOPMENT, PHASE 4-5 Annual Technical Progress Report, 1 Jul. 1979 - 30 Jun. 1980
Oct. 1980 491 p refs
(Contracts DE-AB01-77ET-10069; EF-77-A-01-2893)
(FE-2893-53) Avail: NTIS (US Sales Only) HC A21/MF A01; DOE Depository Libraries

Laboratory process research and development studies conducted in support of a donor solvent coal liquefaction process are reported. Topic covered include: operation of recycle units in the one ton per day pilot plant; solvent hydrogenation; catalysts; validation of the once-through unit; high pressure liquefaction; chemical structure of bottoms; coking yields; bottom solidification; hydrogen production; materials handling; erosion resistant nozzles; cost reduction; commercialization and industrial wastes; environmental engineering; value engineering, and laboratory guidance procedures. A.R.H.

N81-18241# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
STUDIES OF THE MECHANISM OF COAL HYDROGENATION BY ELECTRON SPIN RESONANCE Quarterly Technical Progress Report, 1 Jun. - 31 Aug. 1980
Ira B. Goldberg Nov. 1980 17 p refs
(Contract DE-AC22-80PC-30072)
(DOE/PC-30072/T2) Avail: NTIS HC A02/MF A01

This is the second quarterly report on the program Studies of Coal Hydrogenation by electron spin resonance was studied with emphasis on cell and heating rate optimization for carrying out in situ measurements. Preliminary characterization of the coal to be used was carried out. DOE

N81-18242# Southwest Research Inst., San Antonio, Tex.
HYBRID FUELS FOR HIGHWAY TRANSPORTATION Annual Technical Progress Report, 1 Jun. 1979 - 1 Jun. 1980
T. W. Ryan, W. Likos, and C. A. Moses Jun. 1980 134 p refs
(Contract DE-AC04-78CS-54240)
(DOE/CS-54240/T1; ATPR-2) Avail: NTIS HC A07/MF A01

A program was developed to investigate the potential of hybrid fuels for use in highway transportation. Hybrids are fuels derived from combinations of readily available energetic non-conventional materials with petroleum. They are generally formulated as solutions, emulsions, or slurries. The underlying objective of the program is to reduce the use of petroleum derived fuels and/or to minimize the processing requirements of the finished hybrid fuels. During the first year of the program, extensive work was done on the development and testing of water and alcohol emulsions and alcohol solutions. In the second year, the emphasis was placed on the development and testing of hybrid fuel slurries. Components evaluated included carbohydrates and various forms of carbon. It was concluded that, of the slurries tested, the carbon (coke, carbon black, etc.) slurries have the most potential for development into finished fuels. The efforts during the third year will concentrate on advancing the development of the slurries (especially the carbon slurries) to the same point as the solutions and emulsions. DOE

N81-18018*# Boeing Commercial Airplane Co., Seattle, Wash.
IMPACT OF CHANGING FUEL CHARACTERISTICS ON SUPERSONIC CRUISE AIRPLANE
O. J. Hadaller, J. E. Schmidt, A. M. Momenthy, and P. E. Johnson *In* NASA. Langley Research Center Supersonic Cruise Res., 1979, Pt. 2 Mar. 1980 p 855-872 refs (For primary document see N81-18005 09-01)
Avail: NTIS HC A18/MF A01 CSCL 21D

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-18243# National Aeronautical Lab., Bangalore (India).
MEASUREMENT OF THICKNESS OF THIN FILMS BY THE X-RAY DIFFRACTION METHOD
C. Srinivasan, C. Balasingh, and A. K. Singh Jul. 1979 23 p refs
(NAL-TN-55) Avail: NTIS HC A02/MF A01

The X-ray diffraction method was used to measure the thickness of thin films (coatings). The principle and the experimental details of the X-ray diffraction methods were examined. The intensities of the diffracted beams were derived assuming a random orientation of the crystallites in the diffracting medium. Consequently, the expressions were not valid when the sample has preferred orientation. To check the performance of the method, thicknesses of nickel deposits on mild steel plates were determined by the X-ray diffraction method and the results compared with those obtained by the weighing method and metallographic examination. The weighing method which gives an accuracy of

+ or - 1 micron was taken as the standard. The X-ray diffraction methods and the metallographic examinations were values within + or - 1 micron of the value obtained by the weighing method. R.C.T.

N81-18244# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN NO. 1980-2, MARCH - APRIL 1980

Claude Sevestre, ed. ESA 1980 79 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 77-145
(ESA-TT-652) Avail: NTIS HC A05/MF A01

Topics include turbulence formation, flow separation over swept wings, a closed-cycle helium turbine for solar power applications, elliptical flow computation, characterization of aircraft radar echoes, and a dynamic computer memory allocation system. For individual titles, see N81-18245 through N81-18250.

N81-18245# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

COMMENTS ON TURBULENCE c34

Robert Legendre *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 1-7 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 77-83 Original report in FRENCH previously announced as A80-46226 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

Underlying assumptions in studying mechanisms of turbulence formation are critically reviewed in the framework of scientific philosophy. The dangers of confusing a concept based on observation of phenomena with the mathematical derivation which interprets it, are emphasized. An analysis of very simple schemes is preferred to abstract study with initially inconsistent hypotheses. Author (ESA)

N81-18246# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

STRUCTURES OF FLOW SEPARATIONS OVER SWEPT WINGS c02

Henry Werle *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 9-33 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 85-108 Original report in FRENCH previously announced as A80-46227 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

The systematic study of the singularities characterizing the various types of separations which develop over swept wings, particularly at high angles of attack were studied by means of flow visualization in a water tunnel. From these results obtained at low speed, a number of fundamental schemes can be derived that emphasize the complex vortex structure of these phenomena from their formation more or less close to the apex until their disorganization downstream. This analysis, which distinguishes full wings and wall-mounted half wings, covers the effects due to the main parameters of flow, aircraft configuration and wing shape. Author (ESA)

N81-18247# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CLOSED-CYCLE HELIUM GAS TURBINE FOR SOLAR TOWER POWER PLANT c44

Pierre Duran *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 35-50 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 109-122 Original report in FRENCH previously announced as A80-46228 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

Closed-cycle helium gas turbines with an atmospheric cold heat source, currently under development for very high temperature nuclear power plants, are discussed for use in solar energy conversion systems not requiring long term thermal storage. In the 10 MW-el range, and with a turbine inlet temperature of 900 C, the thermal efficiency of a complex gas turbine, including cooling between low pressure and high pressure compressors as well as reheating between high pressure and low pressure turbine and regenerative heat exhangers, lies between 41 and 43%. The efficiency is constant in time and is sustained even at off-design operation; it is equivalent to the efficiency achieved by a thermal power plant, which allows running the solar plant with an auxiliary fossil fuel combustor. Author (ESA)

N81-18248# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

AN IMPLICIT FINITE VOLUME METHOD FOR ELLIPTICAL FLOW COMPUTATION c34

Denis Dutoya and Pierre-Jacques Michard *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 51-59 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 123-129 Original report in FRENCH previously announced as A80-46229 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

A time integration scheme is given for the conservation equations for aerothermodynamic problems. The space discretization employed uses the finite volume method, which retains the conservative character of the basic equations. The time integration procedure is based on a linearized, implicit second-order method, which anticipates the variation of aerodynamical quantities by implicitly coupling mass and momentum equations through a linearized pressure equation. In such a way, the numerical scheme escapes the CFL stability requirements, and thus allows fast calculation of low frequencies and fast convergence towards a stationary solution. Examples of calculation results are presented to illustrate applications in turbomachinery studies. Author (ESA)

N81-18249# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CHARACTERIZATION OF RADAR ECHOES ON AIRCRAFT c32

Christian Pouit *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 61-71 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 131-139 Original report in FRENCH previously announced as A80-46230 Sponsored by DRET (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

A holographic method is used to acquire a large number of values of the backscattering coefficient picked on a target as a function of frequency and of one angle. The method models the complex effects originating in aircraft canopies, radomes, and cavities. The two dimensional fourier transform is used to calculate a distribution of isotropic bright spots as well as distributions representing reflection and diffraction waves on surfaces. An application, reduction of wave surface distortions in radar cross section measurements amde close to the target, is shown. Author (ESA)

N81-18250# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

A CORE MEMORY MANAGEMENT SYSTEM c60

Yves Gorge *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-562) 1980 p 73-77 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 141-145 Original report in FRENCH previously announced as A80-46231 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

An algorithm for dynamic assignment of arrays in core storage when programming in FORTRAN is described. Least often used arrays are transferred to secondary storage while new addresses of remaining arrays are recalculated. A file of ages is used, updated at each use of an array according to a criteria defined by the user when designing the program. The algorithm is used in a core memory management scheme operational on a UNIVAC 1100. Author (ESA)

N81-18251# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NO. 1980-3, MAY - JUNE 1980

Claude Sevestre, ed. ESA 1980 79 p refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 147-218
(ESA-TT-609) Avail: NTIS HC A05/MF A01

Methods for calculation of unsteady boundary layers in direct or inverse mode are considered as well as the development of surface temperature fluxmeters. Also included are: the computation of flows having rolled up vortex sheets; a study of separation at the trailing edge of an afterbody; and convective transfers in infrared thermography in wind tunnels. For individual titles, see N81-18252 through N81-18258.

N81-18252# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CALCULATION OF UNSTEADY TURBULENT BOUNDARY LAYERS IN DIRECT OR INVERSE MODE, INCLUDING REVERSE FLOWS: ANALYSIS OF SINGULARITIES c34

Jean Cousteix, Jean-Claude LeBalleur, and Robert Houdeville *In its La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 3-13 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 147-157 Original report in FRENCH previously announced as A80-43545* (For primary document see N81-18251 09-31)

Avail: NTIS HC A05/MF A01

The nature of the system of the unsteady turbulent boundary layer equations is investigated through the global equations of continuity, momentum and entrainment, either in the direct mode, or in the inverse mode. In the direct mode, with a prescribed pressure, it is shown that, unlike the steady case and a few particular flows excepted, the occurrence of reversed flow does not generate a singularity, but actually involves the existence of an upstream influence. In the case of an inverse mode, the problem is closed with a prescribed evolution, either for a characteristic quantity of the boundary layer (for example the displacement thickness), or for a parameter which should be deduced from a coupling with the inviscid flow. It is shown that an inverse unsteady integral method of practical interest can be defined for configurations including reverse flow, and that a numerical integration marching from upstream to downstream is then still possible. Author (ESA)

N81-18253# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DEVELOPMENT OF SURFACE TEMPERATURE FLUXMETERS c35

Joel Guernigou, Claude Indrigo, Yves Maisonneuve, and Pierre-Gerard Mentre *In its La Rech. Aerospatiale, Bimonthly Bull. no. 1980-3 (ESA-TT-657) 1980 p 15-25 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 159-168 Original report in FRENCH previously announced as A80-43545* (For primary document see N81-18251 09-31)

Avail: NTIS HC A05/MF A01

Small scale surface temperature fluxmeters were developed for the study of solid propellant ignition. A cathodic spray coating technique makes it possible to obtain thermometer elements that are well calibrated and homogeneous, and show good adherence to the surface of the calorimeter element. The design and calibration of these thin film fluxmeters are described and two examples of the application of these instruments to the measurement of heat flux in solid propellant systems are examined. Author (ESA)

N81-18254# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

A PREDICTION MODEL FOR ATMOSPHERIC POLLUTION CAUSED BY A POLLUTANT SOURCE c45

Anne-Marie Bouchardy *In its La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 27-33 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 169-175 Original report in FRENCH previously announced as A80-43546* (For primary document see N81-18251 09-31)

Avail: NTIS HC A05/MF A01

A model is presented that can be used to predict the risk of pollution from a simple source (smoke stack, aircraft, etc.) to a distance several kilometers from the point of emission and up to several hours after the emission. The model takes into account the effects of temperature or velocity differences with respect to the ambient air as well as transport and turbulent diffusion. Author (ESA)

N81-18255# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

HARDENING AND FATIGUE DAMAGE INTERACTION IN 316 L STEEL c26

Jean-Louis Chaboche, Henri Kaczmarek, and Pascal Raine (Ecole Norm. Super. de l'Enseignement Tech.) *In its La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 35-55 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 177-196 Original report in FRENCH previously announced as A80-43547* (For primary document see N81-18251 09-31)

Avail: NTIS HC A05/MF A01

A fatigue damage equation, previously developed for other materials, is extended to the case of 316 L steel by introduction of an additional internal variable which retains the memory of the maximum plastic strain range applied to the specimen. This equation applies to fatigue life prediction under periodic or aperiodic loading, with or without prestraining, and permits the correct modelling of the damage evolution as measured macroscopically by using the effective stress concept. Author (ESA)

N81-18256# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

NUMERICAL COMPUTATION OF FLOWS WITH ROLLED-UP VORTEX SHEETS c34

Serge Huberson *In its La Rech. Aerospatiale Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 57-63 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 197-207 Original report in FRENCH previously announced as A80-43548* (For primary document see N81-18251 09-31)

Avail: NTIS HC A05/MF A01

Vortex sheet numerical simulation using point vortices cannot give a good representation of the flow in the highly rolled up part of the sheet. The proposed numerical simulation relies on an analytical algorithm due to Guiraud and Zeytounian according to which the irrotational flow with a embedded highly rolled vortex sheet is asymptotically equivalent to one with no vortex sheet. The flow in the core is governed by the incompressible Euler equations which are solved by a finite difference method and the remaining portion of the sheet is represented by classical point vortices. This method is applied to the symmetrical Kaden problem (trailing edge vortex sheet). Author (ESA)

N81-18257# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

EXPERIMENTAL STUDY OF THE SEPARATION AT THE TRAILING EDGE OF AN AXISYMMETRICAL CONTOURED AFTER-BODY c02

Jean-Louis Solignac *In its La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 65-71 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 205-211 Original report in FRENCH previously announced as A80-43549* (For primary document see N81-18251 09-31)

Avail: NTIS HC A05/MF A01

External flow separation upstream of the trailing edge of a profiled body are analyzed on an axisymmetric afterbody. The aerodynamic field is examined using pressure probes, hot wires, and a laser velocimeter. These measurements are supplemented by visualizations. It is possible to define the structure of the mean flow and characterize turbulence properties in the separation and the adjacent mixing zones. Low frequency unsteady aspects which are seemingly associated with the generation of large turbulent structures in the mixing zone of the internal flow are also examined. Author (ESA)

N81-18258# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

IMPROVEMENTS IN THE DETERMINATION OF CONVECTIVE TRANSFERS FROM INFRARED THERMOGRAPHY c34

Daniel L. Balageas and Dominique Ory *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 73-79 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 213-219 Original report in FRENCH previously announced as A80-43550 (For primary document see N81-18251 09-31)
Avail: NTIS HC A05/MF A01

Modeling of a semi-infinite plane wall was used to determine maps of convective transfer coefficients. A systematic evaluation of the error involved in the use of the model of the semi-infinite plane slab in the case of a model with a finite thickness was carried out. It was possible to show the existence of correlations between this error and dimensionless groups built from the Fourier and Biot numbers relative to the thickness of the wall. With respect to the side not subjected to aerodynamic flow, two cases were considered: heat insulation; and imposed temperature equal to the initial temperature. Author (ESA)

N81-18259# Blume (John A.) and Associates Research Div., San Francisco, Calif.
WIND LOADING AND RESPONSE OF A HIGH-RISE BUILDING
Russell S. Mills 1981 16 p refs Presented at the Conf. on the Dyn. Response of Struct., Atlanta, 14 Jan. 1981
(Contract DE-AC08-76DP-00099)
(CONF-810104-1) Avail: NTIS HC A02/MF A01

An instrumentation system suitable for the measurement of wind loading and structural response was implemented in a 16 story Las Vegas building. The use of a displacement measuring system consisting of a vertically aligned laser and a light sensitive diode permits evaluation of quasistatic as well as fluctuating response. Experimental results from several wind storms were compared to a method for analytically predicting alongwind structural response. The analytical method was found to underestimate the actual building response. DOE

N81-18260# Hampton (Delon) and Associates, Silver Spring, Md.
REPRESENTATIVE GROUND PARAMETERS FOR STRUCTURAL ANALYSIS OF TUNNELS. VOLUME 2: IN SITU TESTING TECHNIQUES Final Report, 22 Sep. 1976 - 31 Jan. 1980
Delon Hampton, Randall J. Essex, and T. G. McCusker Oct. 1980 323 p refs
(Contract DOT-FH-11-9150)
(PB81-122038; FHWA/RD-80-013-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 13B

The development of a technically sound and economically feasibile solution to the problem of obtaining better and more accurate predictions of geologic conditions are considered. A numerical characterization of ground properties for engineering application in tunnel design and construction is presented. Several in situ testing techniques are examined. A summary of classification systems and correlations which are applicable to underground design and construction are included. R.C.T.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-18261 California Univ., Los Angeles.
BANDWIDTH EFFICIENT COMMUNICATION AND CODING Ph.D. Thesis
David Eugene Jackson 1980 133 p
Avail: Univ. Microfilms Order No. 8104001

Bandwidth efficient frequency modulation (FM) techniques are considered with respect to problems of comparing competing modulation/demodulation systems as well as the lack of an adequate phase tracking system for coherent demodulation of the more complex (and more bandwidth efficient) FM techniques. Two demodulators are specifically considered: the coherent maximum likelihood demodulator; and the simultaneous phase/data demodulator that obviates a separate phase tracking system. Dissert. Abstr.

N81-18262 Alabama Univ., Huntsville.
APPLICATION OF CHARGE COUPLED DEVICES TO RADAR SIGNAL PROCESSING Ph.D. Thesis
Fredric Hallie Clark 1980 255 p
Avail: Univ. Microfilms Order No. 8103974

The signal processing requirements of a state of the art radar system were analyzed and alternative implementations through the use of the charge coupled device (CCD) technology were investigated. Since the retention of the performance of the baseline system is of prime importance, a hypothetical threat was assumed with the resulting signal processing flows and detection contours obtained for the classical implementation. Automated analysis tools, which permit scenarios to be studied in a variety of environments, were generated to provide the results of signal to noise calculations. The subsystems not directly related to signal processing were also developed for completeness. An introduction to the (CCD) technology was formulated with derivatives made for the required CCD implementations. These models were then incorporated into the radar system. A digital computer simulation model was developed for the CCD configuration with outputs compared to theoretical system calculations for evaluation. Through a series of sample problems, the validity of the CCD implementation was established. Dissert. Abstr.

N81-18263 Carnegie-Mellon Univ., Pittsburgh, Pa.
LARGE-SCALE OPTIMIZATION FOR DESIGN SYNTHESIS OF COMMUNICATION NETWORKS WITH APPLICATION TO RATE ELEMENT SYSTEMS Ph.D. Thesis
Dah Nain Lee 1980 111 p
Avail: Univ. Microfilms Order No. 8100617

A telecommunication network hierarchy is defined which includes important cases occuring in the field and appearing in the literature. A different use of the classical concept of the marginal capacity of an additional trunk a prescribed blocking probability leads to a linear programming supply model which is used to compute the sizes of all the high usage groups. The sizes of the remaining trunk groups are approximated by the linear programming model, but can be determined more accurately by alternate methods once all high usage group sizes are computed. Dual interpretations and sensitivity analyses of linear programming are derived for the study of rate making principles and rate elements on service rate fillings. Numerical results are presented for two examples based on field data, one of which was designed by the multi-hour engineering method.
Dissert Abstr.

N81-18264 Purdue Univ., Lafayette, Ind.
NONPARAMETRIC DETECTORS WITH APPLICATIONS TO SPREAD-SPECTRUM Ph.D. Thesis
David Paul Grybos 1980 151 p
Avail: Univ. Microfilms Order No. 8102660

A brief overview of the complete land mobile spread spectrum system is presented. The design and performance of the receiver used in the system is described. A convenient model for the proposed receiver is described. The implementation of various receiver structures is then discussed and a possible structure that can be constructed with current technology proposed. Models for the urban mobile channel are explained and the performance of the receiver in these channels computed. It is shown that the receiver is reasonably robust for a variety of channel models that correspond to average conditions. The performance of the receiver in channels that may possibly correspond to difficult locations in an urban environment is also shown. These performance results will aid in the design of a practical system.
Dissert. Abstr.

N81-18265 Purdue Univ., Lafayette, Ind.
IMPROVED AND ROBUST ESTIMATION OF NONRANDOM WAVEFORMS Ph.D. Thesis
Carlos Arturo Pomalaza-Raez 1980 128 p
Avail: Univ. Microfilms Order No. 8102696

The problem of estimating nonrandom signal parameters when some a priori information about these parameters is available and when the contaminating noise is not Gaussian or is only in an approximate manner is considered. Utilization of a priori

knowledge in the estimation procedures is discussed by describing two general concepts: the minimax method; and the generalized Bayes approach. It is shown that for certain kinds of constraints the minimax method provides a solution relatively easy to obtain and one whose mean squared error is smaller than those obtained by more conventional procedures such as the maximum likelihood method. For other types of constraints the generalized Bayes approach utilizing noninformative priors allows incorporation of constraints into the solution of the problem. Often the noninformative priors are not valid probability distribution functions; however, an a posteriori distribution will exist and can, in some sense, be interpreted as an appropriate posteriori distribution. An application of these two methods is illustrated in the estimation of the visual evoked response of the brain to a light stimulus.
Dissert. Abstr.

N81-18266*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SYNTHETIC APERTURE RADAR AND DIGITAL PROCESSING: AN INTRODUCTION
Alan DiCenzo 15 Feb. 1981 76 p refs
(Contract NAS7-100)
(NASA-CR-163985; JPL-Pub-80-90) Avail: NTIS HC A05/MF A01 CSCL 17I

A tutorial on synthetic aperture radar (SAR) is presented with emphasis on digital data collection and processing. Background information on waveform frequency and phase notation, mixing, Q conversion, sampling and cross correlation operations is included for clarity. The fate of a SAR signal from transmission to processed image is traced in detail, using the model of a single bright point target against a dark background. Some of the principal problems connected with SAR processing are also discussed. A.R.H.

N81-18267# Royal Netherlands Meteorological Inst., De Bilt. Machinale Bewerking Waarnemingen/Centrale Weerdienst.
TELECOMMUNICATION NEEDS AT THE ROYAL NETHERLANDS METEOROLOGICAL INSTITUTE (KNMI). A SURVEY: 1980-1990 [TELECOMMUNICATIEBEHOEFTE KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT (KNMI) 1980-1990. EEN VERKENNING]
E. H. J. Vermaas and J. M. Terpstra 1980 57 p refs In DUTCH
(KNMI-V-351) Avail: NTIS HC A04/MF A01

An inventory of the expected telecommunication needs for meteorological information in the next 10 years is presented. Present automated systems are reviewed, expected development for the years 1980 - 1990 are analyzed, and an effort is made to describe the utilization of future telecommunication systems. It is emphasized that only technical aspects were considered during the inventory of future developments. Transl. by E.A.K.

N81-18268# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
ANALYSIS OF RANDOM NON-STATIONARY SIGNALS BY RECURSIVE IDENTIFICATION Ph.D. Thesis [ANALYSE DES SIGNAUX ALEATOIRES NON STATIONNAIRES PAR IDENTIFICATON RECURSIVE]
Sid-Ahmed Lakehal Jul. 1980 162 p refs In FRENCH
Sponsored by Association pour le Development des Commun.
(ENST-E-80008) Avail: NTIS HC A08/MF A01

The theory of time frequency representations of nonstationary processes such as those encountered in electroencephalography is discussed as well as the recursive identification of time models. Some classic results are reviwed and the augmented segmentation of signals is considered. Topics covered include stochastic approximation, the least squares method, the convergence of recursive algorithms, and parametric techniques.
Transl. by A.R.H.

N81-18269# Naval Environmental Prediction Research Facility, Monterey, Calif.
ASSESSMENT/FORECASTING OF ANOMALOUS MICROWAVE PROPAGATION IN THE TROPOSPHERE USING MODEL OUTPUT Final Report
Wayne Sweet Oct. 1980 43 p refs
(AD-A094280; NEPRF-TR-80-05) Avail: NTIS HC A03/MF A01 CSCL 20/14

A method for forecasting microwave propagation conditions below the 850 mb level is described and evaluated using radiosonde data in the eastern North Pacific Ocean. The method demonstrates good skill in assessing the existence of ducting or normal propagation conditions below the 850 mb level. Duct altitudes are not provided in the assessment, nor are the probabilities of occurrence. The categorical assessment is based on an 850 mb parameter derivable from model output fields, and can be used in ocean regions characterized by a marine inversion below the 850 mb level. The method does not seem useful in ocean regions at high latitudes or in those characterized by warm surface currents. GRA

N81-18270# Naval Underwater Systems Center, New London, Conn.
PERFORMANCE OF THE OPTIMUM AND SEVERAL SUBOPTIMUM RECEIVERS FOR THRESHOLD DETECTION OF KNOWN SIGNALS IN ADDITIVE, WHITE, NON-GAUSSIAN NOISE
Raymond F. Ingram and Robert Houle 24 Nov. 1980 42 p refs
(ZR0000117; ZR0000101)
(AD-A094266; NUSC-TR-6339) Avail: NTIS HC A03/MF A01 CSCL 17/2

The optimum and several suboptimum receivers for the detection of known signals in additive, white, non-Gaussian noise are identified. The performance of these nonlinear receivers is parametrically compared with the optimum Gaussian receiver using Middleton's Class B Noise Model. The performance of the extremely low frequency (ELF) receiver for the Propagation Validation System is shown to be within 0.5 dB of the optimum for high-level ELF noise. GRA

N81-18271# Pacific-Sierra Research Corp., Santa Monica, Calif.
AN INTEGRAL EQUATION APPROACH TO THE PROPAGATION OF LOW-FREQUENCY GROUND WAVES OVER IRREGULAR TERRAIN 1: GROUND-BASED TERMINALS
S. Gayer, E. C. Field, Jr., and B. DAmbrosio Griffiss AFB, N.Y. RADC Nov. 1980 72 p refs
(Contract F19628-78-C-0088; AF Proj. 2304)
(AD-A094233; PSR-929; RADC-TR-80-334) Avail: NTIS HC A04/MF A01 CSCL 17/7

Numerical calculations and theoretical developments demonstrate how topography and various approximations affect the calculated propagation of a ground wave. Extensive numerical results are presented for generic terrain types selected to illustrate salient features of solutions to the integral wave equation. Results for simple hills show that arc-length correction of the propagation path is insignificant compared with geometric effects on phase speed in predicting phase retardation. Isolated terrain features cause large local perturbations in phase arrival; far beyond the irregularity on the propagation path, effects are observable but diminish with distance. T.M.

N81-18272# Rome Air Development Center, Griffiss AFB, N.Y.
PREDICTION OF ELECTROMAGNETIC SCATTERING FOR ROUGH TERRAIN USING STATISTICAL PARAMETERS DERIVED FROM DIGITIZED TOPOGRAPHIC MAPS
R. J. Papa, J. F. Lennon, and R. L. Taylor Sep. 1980 26 p refs
(AF Proj. 2305)
(AD-A094104; RADC-TR-80-289) Avail: NTIS HC A03/MF A01 CSCL 17/9

For terrain which is gently undulating and whose surface height excursions are large compared to a wavelength, well known formulas for the normalized bistatic cross section as a function of the polarization states of the incident and scattered EM waves are available in the literature. There are also several theoretical models which describe the EM scattering cross section of surfaces characterized by two scales of roughness. The present analysis applies parameter estimation techniques to a digitized topographic data base. The results are used in a hypothesis test to determine the best probability density function (PDF) for the given map data. The accuracy of the analysis depends on the available data, the estimators employed, and the determination of appropriate PDF's. The example which will be discussed consists of a large number of terrain regions in an area of eastern Massachusetts. This area was chosen because experimental data

in the form of electromagnetic forward scattering from the surface are available. Because of the number of cases involved, the complexity of the multivariate height distributions, and the type of measurements available, only a single observation of the multivariate data is used in the present analysis. The results of the statistical analysis for mean height, variance, correlation, PDF, and a geologic feature characterizing each subregion are presented. GRA

N81-18273# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF A VOICE FUNNEL SYSTEM Quarterly Technical Report, 1 Feb. - 30 Apr. 1980
R. D. Rettberg Jan. 1981 32 p
(Contract MDA903-78-C-0356; ARPA Order 3653)
(AD-A094026; BBN-4564; QTR-7) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report covers work performed on the development of a high-speed interface, called a Voice Funnel, between digitized speech streams and a packet-switching communications network. GRA

N81-18274# Illinois Univ. at Urbana-Champaign. Electromagnetics lab.
A STUDY OF MICROSTRIP ANTENNA ELEMENTS AND ARRAYS Interim Report
Y. T. Lo, W. F. Richards, and P. Simon Griffiss AFB, N.Y. RADC Dec. 1980 82 p refs
(Contract F19628-78-C-0025; AF Proj. 2305)
(AD-A094068; RADC-TR-80-363) Avail: NTIS HC A05/MF A01 CSCL 09/5

Thin microstrip antennas have many unique and attractive properties, but their operation is much limited in bandwidth. In this report an attempt is made to develop a procedure for array design, in particular, to determine whether or not the band of operation could be broadened by using a small array of two elements of slightly different dimensions. By broadband, it is meant that the antenna must have over the bandwidth: (1) an input impedance variation within a certain prescribed SWR (say 3:1); (2) a stable pattern (in particular a stable beam-pointing direction); (3) a small variation in gain (or efficiency); and (4) in some applications, small variations in beamwidth and sidelobe level. In this work only the first two fundamental performances are considered. Insofar as the impedance is considered, the array design is essentially a circuit problem. Our theory, based on the cavity model, has previously shown that the element impedance can adequately be described by a Foster network representation, namely, a series circuit of infinitely many parallel resonant circuits, each corresponding to a mode of the cavity. For frequencies in the vicinity of a certain mode, the circuit can further be reduced to a single parallel resonant circuit of that mode in series with an inductance. Our earlier investigation has also shown that, except for very close spacings, the mutual coupling effect between elements can be ignored. GRA

N81-18275# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
INVESTIGATION OF CHARGE COUPLED DEVICES FOR SIGNAL PROCESSING Final Technical Report, 15 Apr. 1977 - 1 Jun. 1980
C. T. Sah, P. C. Chan, J. F. Detry, and Y. C. Sun Dec. 1980 85 p refs
(Contract F19628-77-C-0138; AF Proj. 2306)
(AD-A094069; SCIENTIFIC-4; RADC-TR-80-333; TR-4) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report describes a noise correlation processor for automatic low frequency noise power spectra measurements, theoretical analysis of hot electron effects and trapping noise in silicon charge coupled devices, small-signal equivalent circuit measurement of SiO2 - Si interface states, the voltage stimulated capacitance transient spectroscopy (VSCTS or DLTS) of silicon bulk deep levels due to impurities and ion implantation damage for buried channel CCD, spurious DLTS surface signal, and CCD performance limitations by interband impact ionization effects due to high electric field in the gap and under the gate of CCD. GRA

N81-18276# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TRAPPED RADIATION EFFECTS ON THE SPACE BASED RADAR
David M. Towle 14 Oct. 1980 46 p refs
(Contract F19628-80-C-0002; DARPA Order 3724)
(AD-A094065; SBR-2; ESD-TR-80-215) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report presents the results of a parametric study regarding the influence of radiation damage effects on possible configurations of a phased array Space-Based Radar System. Primary emphasis is on Van Allen type trapped radiation effects on solar cells and on the antenna transmitter/receiver modules. Qualitative references to man-made nuclear radiation effects are also given. It is concluded that weight penalties for shielding against trapped radiation effects are sufficiently high in the intermediate altitude regime, 2,000 to 9,000 km altitude, to drive the design choices to higher or to lower altitude regimes. GRA

N81-18277# ITT Gilfillan, Inc., Van Nuys, Calif.
COMMUTATING FEED ASSEMBLY Final Technical Report, Dec. 1978 - Feb. 1980
Ronald I. Wolfson Griffiss AFB, N.Y. RADC Jun. 1980 177 p
(Contract F19628-79-C-0034; AF Proj. 2448)
(AD-A094470; RADC-TR-80-180) Avail: NTIS HC A09/MF A01 CSCL 17/9

The principal activities performed during the Commutating Feed Assembly contract include development of a stripline feed network and non-contacting loop couplers for low-loss transfer and distribution of RF energy. The commutator described not only has superior electrical performance over that of an electronic system, but also offers improvements in reliability and life-cycle cost. It can be accessibly located where maintenance actions are more easily carried out than in an electronically-scanned system or a conventional rotating antenna. Non-contacting loop couplers achieve low-loss transfer and distribution of RF energy, with precise control of amplitude and phase that is needed to realize low sidelobe levels. This method of coupling is preferable to the capacitive coupling used in existing electromechanical commutating feeds, where illumination flutter results in unacceptable MTI performance. To obtain multiple beam groups in elevation, two or more commutators may be stacked on a common drive shaft. GRA

N81-18278# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.
SOME RESULTS IN NOISE FILTERING BY USE OF LOCAL STATISTICS
P. F. Yan (Tsinghua Univ., Beijing) and P. F. Li (Beijing Inst. of Posts and Telecommunications) 30 Jan. 1981 11 p
(Contract N00014-79-C-0494)
(AD-A094603; SMU-EE-TR-81-6) Avail: NTIS HC A02/MF A01 CSCL 17/1

An alternative approach is presented for the noise filtering using local statistics, a problem recently considered by Jong-Sen Lee. For the multiplicative noise case improved filtering by the new method is demonstrated by experimental results. GRA

N81-18279# Naval Postgraduate School, Monterey, Calif.
PARAMETRIC SIMULATION OF TACTICAL SINGLE CHANNEL FREQUENCY MODULATED COMMUNICATIONS M.S. Thesis
Philip Andrew Olson, Jr. Sep. 1980 53 p refs
(AD-A094598) Avail: NTIS HC A04/MF A01 CSCL 17/2

This thesis presents a stochastic simulation model of single channel FM communications that is designed to be used in conjunction with the Simulation of Tactical Alternative Responses (STAR) Combat Model. The communications modeled, the assumptions made, and the interface requirements necessary for inclusion of the communications model in the STAR Combat Model are explained in detail. The computer code that is used to execute the Communications Model is included in the appendices. An overview is given of those portions of the basic STAR Model with which the Communications Model interfaces directly to provide the reader with sufficient background for the discussion of the Communications Model. The communications input requirements of the model, a definition of the purpose of each routine and event, and definitions of each global variable, set, and entity are provided so that this thesis can serve as a user's manual for the Communications Model. GRA

N81-18280# Texas Univ., Austin. Dept. of Physics.
GEOMETRY OF WAVE ELECTROMAGNETICS
E. C. G. Sudarshan 27 Oct. 1980 12 p refs Prepared in cooperation with Harvard Univ.
(Contract DE-AS05-76ER-03992; Grant NSF PHY-77-22864) (DOE/ER-03992/427) Avail: NTIS HC A02/MF A01

A challenge to the commonly held view of light as a wave phenomenon is presented. An exact realization of light as generalized pencils of rays is constructed, with stress placed on using pencils of rays rather than single rays. Exact equations of motion are presented for the rays in the pencil, and these rays tend to travel in straight lines in empty space (not too near the edge of the beam). DOE

N81-18281# Fondazione Ugo Bordoni, Rome (Italy).
EXAMINATION OF INTERFRAME REDUNDANCY REDUCTION METHODS FOR IMAGE SIGNALS [ESAME DEI METODI DI RIDUZIONE DI RIDONDANZA 'INTERFRAME' PER SIGNALID D'IMMAGINE]
Guido DiBlasio (Rome Univ.) Nov. 1979 36 p refs In ITALIAN
(FUB-30-1979) Avail: NTIS HC A03/MF A01

Image enhancement of video data is discussed. In particular, methods for reducing interframe redundancy are suggested. Problems involved in interframe coding are included. S.F.

N81-18282# Fondazione Ugo Bordoni, Rome (Italy).
PRELIMINARY DATA ANALYSIS AND INTERPRETATION OF RAIN INTERFERENCE RESULTS [ANALISI PRELIMINARE DEI DATI E INTERPRETAZIONE DEI RISULTATI RELATIVI ALLA DIFFUSIONE DA IDROMETEORE]
Francesco Barbaliscia, Dario Maggiori, Giovanni Mastrandrea, Piergiorgio Migliorini, and Aldo Paraboni Dec. 1979 21 p refs In ITALIAN
(FUB-36-1979) Avail: NTIS HC A02/MF A01

The relationship between radar attenuation and rainfall volume is statistically analyzed in relation to the SIRIO satellite. Data on diffusion and signal transmission are presented and theoretical values assigned. S.F.

N81-18283 Houston Univ., Tex.
A STUDY OF CO-CHANNEL AND INTERSYMBOL INTERFERENCE IN QUADRATURE-CARRIER MODULATION SYSTEMS Ph.D. Thesis
Joao Manuel A. Rego Cruz 1980 198 p
Avail: Univ. Microfilms Order No. 8103738

A method is presented for determining the performance of a quadrature carrier modulation system in terms of its probability of error, in the presence of additive white Gaussian noise, of intersymbol interference and of co-channel interference. This method was applied to determine the bit error rate of several quadrature carrier modulation systems using Butterworth receiving filters of different complexity. It was found that quadrature carrier modulation systems are more sensitive to co-channel interference than binary PSK systems. It was also observed that among all the different quadrature carrier modulation systems studied, SFSK seems to exhibit the best overall performance in a co-channel and intersymbol interference environment. These results are shown through a number of performance curves that provide useful data for the systems designer. Dissert. Abstr.

N81-18249# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CHARACTERIZATION OF RADAR ECHOES ON AIRCRAFT
Christian Pouit *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 61-71 Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 131-139 Original report in FRENCH previously announced as A80-46230 Sponsored by DRET (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

N81-18986*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HISTORICAL DATA ON CHARACTERISTICS OF RADIO SYSTEMS USED FOR UNITED STATES DEEP-SPACE COMMUNICATIONS
N. F. deGroot and H. R. Bahadori *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 7-16 (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 17B

N81-18993*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONVERSION OF THE DSN TELETYPE SUBSYSTEM TO THE EIGHT-LEVEL ASCII NATIONAL STANDARD
G. J. Brunder *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 95-102 (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 17B

N81-18995*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COMMAND SYSTEM OUTPUT BIT VERIFICATION
C. W. Odd and S. F. Abbate *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 112-114 (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-18284 Missouri Univ. -Rolla.
AN IMPROVED METHOD FOR PREDICTING THE LIGHTNING PERFORMANCE OF HIGH AND EXTRA-HIGH-VOLTAGE SUBSTATION SHIELDING Ph.D. Thesis
Tieu Vinh 1980 161 p
Avail: Univ. Microfilms Order No. 8102268

There is a need for better and more effective lightning protection for transmission and switching substations. In the past, a number of empirical methods were utilized to design systems to protect substations and transmission lines from direct lightning strokes. The need exists for convenient analytical lightning models adequate for engineering usage. In this study, analytical lightning models were developed along with a method for improved analysis of the physical properties of lightning through their use. This method of analysis is based upon the most recent statistical field data. The result is an improved method for predicting the occurrence of sheilding failure and for designing more effective protection for high and extra high voltage substations from direct strokes. Dissert. Abstr.

N81-18285 California Univ., Berkeley.
HIGH-RESOLUTION SUCCESSIVE-APPROXIMATION ANALOG-TO-DIGITAL CONVERSION TECHNIQUES IN MOS INTEGRATED CIRCUITS Ph.D. Thesis
Bahram Fotouhi 1980 325 p
Avail: Univ. Microfilms Order No. 8029396

The fundamental limitations on resolution and accuracy of digital to analog and analog to digital converters as realizable in standard metal oxide semiconductor (MOS) large scale integrated (LSI) circuit technology were studied. A new successive approximation analog to digital conversion technique compatible with most MOS process technologies was investigated. This technique combined a string of equal value diffused resistors and a binary ratioed capacitor array in a unique circuit configuration so that 12-bit monotonicity was achieved with only 8-bit ratio accurate circuit elements. The comparator was realized using a chopper stabilized amplifier to reduce the inherently high input offset voltages of MOS amplifiers. Dissert. Abstr.

N81-18286 Cornell Univ., Ithaca, N. Y.
AN EXPERIMENTAL STUDY OF CAPLESS ANNEALING OF ION IMPLANTED GALLIUM-ARSENIDE Ph.D. Thesis
Gary Lynn Harris 1980 151 p
Avail: Univ. Microfilms Order No. 8102979

The science and technology of ion implantation and its application to semiconductor electronics was examined. Doping by ion implantation was used as part of the processing for producing planar structures in GaAs. The capless annealing system consists of a graphite boat containing the implanted sample surrounded by crushed graphite and GaAs. Activations of 60% with correspondingly high mobilities were achieved with this annealing technique. The mobilities correspond to the limitation imposed by the implanted impurity density. Photoluminescence, C-V, Hall measurements, deep level transient spectroscopy and SIMS measurements were used to characterize the implanted and annealed layers. Dissert. Abstr.

N81-18287 California Univ., Los Angeles.
THE DESIGN OF BROADBAND MICROWAVE AMPLIFIERS Ph.D. Thesis
Hassan Babaie 1980 174 p
Avail: Univ. Microfilms Order No. 8103983

Existing techniques in designing microwave narrow band and wideband amplifiers are examined, and approaches toward the design of both type of amplifiers are presented. The procedures described integrate previously developed techniques for the design of matching networks with consideration of the potential unstability of the devices used to achieve a stable amplifier design. Stability factors are described, and their relationships are examined, then for potentially unstable transistors, the design of narrow band and wide band and microwave amplifiers with selected Stern factor, K are carried out. For narrow band system the effect of the Q factor of the coil on the bandwidth, and the design of narrow band amplifiers with selected Q are examined. The matching networks for both type are investigated. The design of matching networks and parasitic absorption techniques for the optimum gain inside the range of operation are shown.
Dissert. Abstr.

N81-18288 Purdue Univ., Lafayette, Ind.
THE CHARACTERIZATION OF SUB-BAND GAP PHOTOCURRENTS AT SINGLE CRYSTAL Ph.D. Thesis
James Nathan Ziemer 1980 271 p
Avail: Univ. Microfilms Order No. 8102728

The application of laser flash electrochemical studies to the study of subband gap photocurrents at single crystal n type TiO2 semiconductor electrodes is discussed. The design and construction of a laser flash coulostatic instrument capable of submicrosecond electrochemical response as well as the experimental design and data analysis necessary for the characterization of the dynamic photochemical processes are detailed. Objectives of the study include: possible application of semiconductor indicator electrodes under flash irradiation; theory of semiconductor electrochemistry; design and construction of the coulostatic apparatus; and experimental design and characterization of the subband gap photocurrent response to both continuous and pulsed irradiation. Potential regions and electrode properties best suited for pulsed studies involving semiconductor electrode/solution chromophore excited state electrochemistry. Dissert. Abstr.

N81-18289 Rhode Island Univ., Kingston.
STATE-SPACE STRUCTURES FOR DIGITAL FILTERS Ph.D. Thesis
Young Kim 1980 216 p
Avail: Univ. Microfilms Order No. 8102531

Synthesis procedures for obtaining optimal second order state space structures are developed for fixed point digital filters based upon sufficient conditions for optimality derived under the assumption of uncorrelated rounding errors from sample to sample and from one error source to another. The second order filters are optimal in the sense that the variance of the output roundoff noise is minimized. The coupled loop second order structure is obtained from the optimal filter via an orthogonal transformation and is close to the optimal filter in noise performance. The predicted roundoff noise outputs for parallel and cascade forms comprised of optimal second order filters are calculated. A computer program was written to determine the optimal filter parameters, and the predicted roundoff noise outputs and to test the validity of the analytical procedures developed.
Dissert. Abstr.

N81-18290 Stanford Univ., Calif.
TWO-DIMENSIONAL IMPURITY DIFFUSION STUDIES: PROCESS MODELS AND TEST STRUCTURES FOR LOW CONCENTRATION BORON DIFFUSION Ph.D. Thesis
Hee-Gook Lee 1980 206 p
Avail: Univ. Microfilms Order No. 8103531

The continuing trend toward the reduction of lateral surface dimensions has resulted in highly two dimensional structures in modern silicon integrated circuits. New analytical 2D process models for ion implantation and impurity diffusion were developed, and they include detailed considerations of the geometry and ambient effects. An approximate expression is derived to model the 2D diffusion of low concentration impurities under local oxidation conditions, and these models are in the 2D device analyses of several small geometry MOS transistors. A technique developed to measure the surface impurity profiles of laterally diffused regions is applied to a number of test structures to determine the lateral distribution of 2D impurity profiles. Diffusion of boron in the nonoxidized area is enhanced by neighboring oxidized regions and this enhancement is a sensitive function of lateral distance. Dissert. Abstr.

N81-18291 State Univ. of New York at Buffalo, Amherst.
DYNAMIC MODELING OF TWO MAGNETICALLY CONTROLLED VACUUM ARC SWITCHES Ph.D. Thesis
Joe Lone Lee 1980 103 p
Avail: Univ. Microfilms Order No. 8104212

The dynamic modeling of two different vacuum arc switches is described. These switches can produce high arc voltages as a result of applied magnetic fields. One of these devices consists of a rod cathode and a hollow anode with the magnetic field applied axially. The other device consists of butt electrodes with transverse magnetic field. These devices are expected to be used in fault current limiting schemes in electrical power systems or in dc switching schemes. The modeling techniques presented can aid in the designing, testing and evaluating new prototypes as well as predicting device operation of future applications. For the first time, current voltage characteristic curves of two devices are derived from available experimental data. The existence of these curves shows the control ability of these devices by applied magnetic fields. Hence, these devices are called Magnetically Controlled Vacuum Arc Switches. Techniques for calculating the response of nonlinear, transient, time varying circuits are used in the modeling. Dissert. Abstr.

N81-18292 Stanford Univ., Calif.
SILICIDES FOR MOS GATES AND INTERCONNECTIONS IN INTEGRATED CIRCUIT TECHNOLOGY Ph.D. Thesis
Farrokh Mohammadi 1980 138 p
Avail: Univ. Microfilms Order No. 8103539

Tungsten disilicide (WSi2) is recommended as one of the principal candidates for gate electrodes and interconnections. After WSi2 was deposited by RF diode sputtering from a hot pressed target of WSi2, the properties of as-deposited and annealed films were analyzed to establish their IC process compatibility. The as-deposited films were observed to be amorphous, with a resistivity of 600 mu omega cm. During thermal oxidation, WSi2 reacts with steam, silicon is consumed to form SiO2, and the remaining film becomes metal rich as a result of the W5Si3 phase. MOS capacitors with WSi2 as the gate material were fabricated on n type (100) silicon, and the work function of tungsten disilicide was measured to be 4.8 eV by means of the MOS capacitance voltage technique. Dissert. Abstr.

N81-18293 California Univ., Los Angeles.
NONPERIODIC FORCED OVERFLOW OSCILLATIONS IN DIGITAL FILTERS Ph.D. Thesis
Henry Samueli 1980 87 p
Avail: Univ. Microfilms Order No. 8102874

Forced overflow oscillations are investigated in a second order digital filter whose input sequence is constructed by uniform sampling a periodic waveform. It is shown that even when the frequency of the input waveform is constrained to an arbitrarily small interval of values, the digital filter is still susceptible to forced overflow oscillations. Furthermore, when the input sequences is obtained by incommensurably sampling a periodic waveform, it is demonstrated that nonperiodic forced overflow oscillations can be sustained in the digital filter. Necessary and

sufficient conditions for the existence of nonperiodic forced overflow oscillation are given. Dissert. Abstr.

N81-18294# Electronics Research Lab., Adelaide (Australia).
A FAST, HIGH VOLTAGE, AVALANCHE TRANSISTOR Q SWITCH DRIVER
B. A. See Aug. 1980 17 p refs
(ERL-0154-TM; AR-002-028) Avail: NTIS HC A02/MF A01

The development of a fast high voltage switching circuit using avalanche transistors is described. The circuit was found eminently suitable for electro-optic Q switching and cavity dumping of lasers. The circuit used the transistor type 2N5192 which was found to have a wide operating range thus allowing the chain to be easily matched to the Q switch voltage requirements. In addition it was proven very robust and not easily damaged by over voltage. M.G.

N81-18295*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
US ARMY REMOTELY PILOTED VEHICLE SUPPORTING TECHNOLOGY PROGRAM
Terrence D. Gossett Jan. 1981 13 p refs
(NASA-TM-81263; A-8450; USAAVRADCOM-TR-81-A-3) Avail: NTIS HC A02/MF A01 CSCL 01C

Essential technology programs that lead to the full scale engineering development of the Aquila Remotely Piloted Vehicle system for U.S. Army are described. The Aquila system uses a small recoverable and reusable RPV to provide target acquisition, designation, and aerial reconnaissance mission support for artillery and smart munitions. Developments that will provide growth capabilities to the Aquila RPV system, as well as future RPV mission concepts being considered by the U.S. Army are presented. Author

N81-18296*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN INVESTIGATION OF RADIOMETER DESIGN USING DIGITAL PROCESSING TECHNIQUES
Roland W. Lawrence Jan. 1981 101 p refs
(NASA-TM-81932) Avail: NTIS HC A06/MF A01 CSCL 09A

The use of digital signal processing techniques in Dicke switching radiometer design was investigated. The general approach was to develop an analytical model of the existing analog radiometer and identify factors which adversely affect its performance. A digital processor was then proposed to verify the feasibility of using digital techniques to minimize these adverse effects and improve the radiometer performance. Analysis and preliminary test results comparing the digital and analog processing approaches in radiometers design were analyzed. R.C.T.

N81-18297# Ente Nazionale per l'Energia Electtrica, Rome (Italy).
REPORTS PRESENTED AT THE 1978 CONFERENCE INTERNATIONAL DES GRANDS RESEAUX ELECTRIQUES A HAUTE TENSION BY THE ITALIAN NATIONAL BOARD ON THE PROJECT 1000 kV [CIGRE: SESSION DE 1978. RAPPORTS PRESENTES PAR LE COMITE NATIONAL ITALIEN SUR LE PROJET 1000 kV]
1979 108 p refs In FRENCH Conf. held in Paris, 30 Aug. - 7 Sep. 1978
Avail: NTIS HC A06/MF A01

The design and construction of a substation and lines for operating in the ENEL network at 420 kV is described. This pilot station contains all the test elements necessary for an ultrahigh network, up to 1,500 kV. Topics covered include shock tests of maneuvering between phases; oil filled cable type construction, properties of power transformers; cracking due to overvoltages; underground cables; coronas and electric fields, insulation, and overhead lines. Transl. by A.R.H.

N81-18298# Engins Matra, Velizy (France). Div. Communications.
INVESTIGATION OF GATE ARRAYS OR SEMI-CUSTOMIZED LSI [ENQUETE SUR LES RESEAUX PREDIFFUSES]
R. Rolland 4 Jun. 1980 65 p In FRENCH
(HJ-41/T/87) Avail: NTIS HC A04/MF A01

The concept of prediffused networks has its origin in the fact that the synthesis of all logic schemes begin with a simple type of operator, a logic gate. A number of operators which are not interconnected can be constructed on the same silicon platelet. This platelet can then be used to produce a large variety of circuits by interconnecting on demand the gates of the networks thus constituted. This interconnection requires a supplementary metallic layer. The advantages of this principle are that the circuits thus constituted have only known operators. The action of the masks, relative to diffusion operations common to all circuits, are designed and constructed from the beginning. Since all the circuits are constructed from identical silicon platelets, the platelets can be diffused in advance, even before the interconnection scheme is defined. The mask of the prediffused nets appears as an imprinted microcircuit which interconnects components already etched in the silicon. Existing products having this technology are described. Transl. by A.R.H.

N81-18299# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
MANUFACTURING METHODS AND TECHNOLOGY FOR DIGITAL FAULT INSULATION OF PRINTED CIRCUIT BOARDS, APPENDIX Final Report
15 Nov. 1980 100 p
(Contract DAAK40-78-C-0290)
(AD-A094300; HAC-FR-80-12-975-App) Avail: NTIS HC A05/MF A01 CSCL 14/2

This report describes the manufacturing technology and test system that will enable detection, identification, and location of digital faults in the advanced missile electronic system that will be used in the 1980's. Emphasis is placed on the fault diagnosis of large printed circuit boards containing complex hybrid digital microelectronic circuits. The Hughes-enhanced, state of the art, DTS-70 automatic test system installed at Redstone Arsenal as a result of this contract provides the capability to isolate digital faults in such circuit boards to the component level with a test comprehensiveness of 90% or better. GRA

N81-18300# Illinois Univ., Chicago. Dept. of Physics.
TOPOGRAPHIC EXAMINATION OF SEMICONDUCTOR SYSTEMS Final Technical Report, 1 Jun. 1978 - 30 Jul. 1980
S. Sundaram and P. M. Raccah Nov. 1980 117 p refs
(Contract N00014-79-C-0809)
(AD-A094276) Avail: NTIS HC A06/MF A01 CSCL 20/12

Using the techniques of modulation spectroscopy, a systematic investigation and characterization of gallium arsenide, indium phosphide, and quaternary alloys of InGaAsP have been completed. The effective tool for the topographic examination of implanted materials is the electrolyte electroreflectance (EER) method. The spatial distribution of carrier concentration, the effects of etching, implantation and anneal procedures on the transition energies have been studied. Besides providing the needed 'feedback' information for the materials growth technology program at NRL, the modulation EER technique is shown to be a very unique and sensitive method for the optical characterization of the 3-5 semiconductors and their alloys. GRA

N81-18301# Celanese Research Co., Summit, N.J.
INTERCALATED GRAPHITE FIBER CONDUCTOR Final Technical Report, 26 Sep. 1979 - 15 Dec. 1980
Ilmar L. Kalnin Dec. 1980 73 p refs
(Contract DAAK70-79-C-0182)
(AD-A094405) Avail: NTIS HC A04/MF A01 CSCL 20/3

Lightweight electrical conductors were developed from graphitic fibers intercalated with highly electrophilic intercalants. Conductance increases of 30-36 times over the unintercalated fibers were observed. This corresponds to about 45% of the specific conductivity of copper at room temperature. Unlike copper, the intercalated graphite fibers exhibit a nearly zero temperature coefficient of conductance. The intercalated yarn did not change its resistance during 100 hours of passage of current at 1 watt power dissipation and current densities of 25-35 A/mm squared. Four graphite 'wires', equivalent in size to 17-20 AWG copper wire were delivered. GRA

N81-18302# Westinghouse Research and Development Center, Pittsburgh, Pa.
INDIUM PHOSPHIDE FOR HIGH FREQUENCY POWER

TRANSISTORS Final Report, 22 Mar. 1979 - 28 Apr. 1980
V. L. Wrick, W. J. Choyke, and R. C. Clarke 28 Sep. 1980 65 p refs
(Contract N00014-78-C-0254; DARPA Order 3535)
(AD-A094601; Rept-243-023-T1) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report covers the conclusion of studies aimed at determining the utility of InP for fabricating power microwave field effect transistors (FET's). This phase of the work provided working transistors which were modeled and compared to their GaAs counterparts. Vapor phase epitaxy (VPE) results are provided for device structures which include high resistivity buffer layers. Ion implantation was aimed at a novel amorphization and low temperature regrowth study to provide implanted p-n junctions in InP for future JFET structures. Processing technology concentrated on a self-aligned diffused gate JFET structure. This technique produced working microwave transistors (JFET) up to 1200 micrometer in gate periphery. The report compares these devices to similar GaAs transistors (MESFET) and makes recommendations for future studies. GRA

N81-18303# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
MICRODIELECTROMETRY: A NEW METHOD FOR IN SITU CURE MONITORING Technical Report, Sep. 1979 - Dec. 1980
Norman F. Sheppard, Steven L. Garverick, David R. Day, and Stephen D. Senturia 19 Dec. 1980 21 p refs Submitted for publication
(Contract N00014-78-C-0591; Grants NSF DMR-78-24185; NSF ENG-77-17192; NR Proj. 356-691)
(AD-A094194; TR-2) Avail: NTIS HC A02/MF A01 CSCL 14/2

Integrated circuit technology has been used to develop a miniature dielectric cure monitor probe that combines small size with built in amplification to achieve good sensitivity down to 1 Hz, making the probe more sensitive to physical property changes than conventional dielectrometers operating at 1000 Hz. This paper describes the design and operation of the microdielectrometer chip, and the model used to determine the complex dielectric constant of the material under study. Two typical applications are illustrated by experiments. First, results of a postcure study of a Versamide 140, Epon 828 mixture are presented and compared to the results of a similar study using a conventional parallel plate capacitor. In a second experiment, several probes were placed in a 100 ml mold and used to monitor the cure of a sample of the same resin system. The data show the nonuniformity of cure within the sample, and can be explained on the basis of gelation and the temperature dependence of the dielectric properties as determined in the post-cure experiment. GRA

N81-18304# Naval Sea Systems Command, Washington, D. C.
CONTRACTING AND MANAGEMENT GUIDE FOR SNEAK CIRCUIT ANALYSIS (SCA)
Sep. 1980 58 p refs
(AD-A094541; NAVSEA-TE001-AA-GYD-010/SCA) Avail: NTIS HC A04/MF A01 CSCL 05/1

This guide presents a description of the Sneak Circuit Analysis (SCA) with primary emphasis on its purpose and potential benefits, as well as cost factors and trade-offs. It is not the intent of the guide to define the exact methods or techniques for the performance of the analysis. The following topics relating to the SCA are addressed: What is a Sneak Circuit Analysis? Why would the SCA be performed? Who performs/participates in the SCA? When should the SCA be performed? How is the SCA ordered and managed? What are the associated cost factors? GRA

N81-18305# *Naval Postgraduate School, Monterey, Calif.*
ADAPTIVE NOTCH FILTER SUPPRESSION OF BENDING MODES M.S. Thesis
William L. Marks Dec. 1980 223 p refs
(AD-A094554) Avail: NTIS HC A10/MF A01 CSCL 09/2

A simple, microprocessor oriented algorithm is developed to identify, track and suppress bending mode signals from a control system's rate and position feedback signals using adaptive digital notch filters. The algorithm can be used to suppress bending modes having center frequencies as close as one octave above the control system gain cross-over frequency without introduction of the excessive phase loss associated with conventional lowpass filtering techniques. A third order model of the trident missile autopilot pitch attitude control loop is contaminated with two dynamic, destabilizing bending modes and used as a concept demonstration model. The algorithm is demonstrated by stabilizing the pitch attitude loop in the presence of two bending modes with unknown gains, damping, center frequencies and rates of change of center frequencies. GRA

N81-18306# Sandia Labs., Albuquerque, N. Mex.
HIGH OUTPUT NEUTRON TUBE USING AN OCCLUDED GAS ION SOURCE
R. J. Walko and G. E. Rochau 1980 16 p refs Presented at the 6th Conf. on Appl. of Accelerators in Res. and Ind., Denton, Tex., Nov. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1493C; CONF-801111-31) Avail: NTIS HC A02/MF A01

The neutron tube consists of an occluded deuterium gas ion source, a single gap accelerator and a scandium tritide target. A feature of the tube design is its complete demountability, permitting replacement or modification of critical components. The ion source is a modified version of a stacked occluded washer source. In contrast to previous designs, this source utilizes only a single scandium deuteride washer and needs no independent trigger. Outputs of 1.2 x 100,000,000,000 neutrons per pulse from a 250 mA deuterium ion beam at 125 kV were obtained for over 1500 consecutive operations with a standard deviation of only + or - 5 percent. The operational lifetime is in excess of 3000 shots based on the present knowledge of ion source behavior. Experiments using nonmagnetic structural components in the ion source resulted in a 26 percent increase in output with a simultaneous 35 percent reduction in the source drive current. Even higher outputs with greater source efficiencies may be achievable. DOE

N81-18307# Bendix Corp., Kansas City, Mo.
ANODIZED ALUMINUM FOIL COIL WITH 538 DEG C CAPABILITIES Final Report
H. F. Jordan Nov. 1980 39 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2525) Avail: NTIS HC A03/MF A01

Solenoid coils were fabricated using barrier anodized aluminum foils as the insulated conductor. Barrier anodization provided a thin turn-to-turn insulation. To construct the coil, wire leads were laser welded to straps that were welded to the foil. The assembled coil was dip coated in Resin 100 for overall insulation. DOE

N81-18308# Los Alamos Scientific Lab., N. Mex.
DC ARC INTERRUPTION IN PRESSURIZED GASSES
Pritindra Chowdhuri 1980 9 p refs Presented at the IEEE Power Eng. Soc. Meeting, Atlanta, Feb. 1981
(Contract W-7405-eng-36)
(LA-UR-80-2344; CONF-810201-1) Avail: NTIS HC A02/MF A01

The purpose of the study was to investigate the possibility of achieving (1) short interruption time and (2) minimum contact erosion in a dc circuit interrupter. Arc interruption tests were performed on a 100 A, 600 V dc contactor under atmospheres of argon dry air, nitrogen, helium and hydrogen, each at four pressures 0.17, 0.34, 0.52, and 0.69 MPa (25, 50, 75 and 100 psig). It was found that the average arcing time in helium and hydrogen was the shortest, and that in argon the longest for the circuit conditions used. The contact erosion in hydrogen was the worst, and that in argon the best for the contact materials used in the tests. The static pressure in the chamber did not appear to have much effect on the arc interruption phenomenon for the contactor and gas pressures used. DOE

N81-18309# Brookhaven National Lab., Upton, N. Y. Physics Dept.
STUDIES OF HIGH-GAIN MICROCHANNEL PLATE PHOTOMULTIPLIERS
K. Oba (Hamamatsu TV Co., Ltd., Japan) and P. Rehak 1980

5 p refs Presented at the IEEE Nucl. Sci. Symp., Orlando, Fla., 5-7 Nov. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28609; CONF-801103-29) Avail: NTIS HC A02/MF A01

The characteristics and performance of several kinds of high-gain micro-channel plate photomultipliers have been investigated. Special attention was directed toward (1) lifetime studies, (2) performance in the magnetic field, and (3) timing properties. Lifetime studies include separate investigations of the photocathode quantum efficiency degradation caused by ion feedback, and the deterioration of the micro-channel plate gain. The dependence of the micro-channel plate photomultiplier gain on the intensity and the direction of the magnetic field (up to 7 kGauss) is reported. DOE

N81-18310# California Univ., Livermore. Lawrence Livermore Lab.
ELASTOMER DIELECTRIC FOR PULSE POWER
L. P. Bradely, E. L. Orham, I. F. Stowers, and J. R. Braucht 30 May 1980 11 p refs Presented at Conf. on Elec. Insulation and Dielectric Phenomena, Boston, 29 Oct. 1980
(Contract W-7405-eng-48)
(UCRL-83997; CONF-8010125-1) Avail: NTIS HC A02/MF A01

Selected elastomer dielectrics are characterized as high voltage insulators for use in pulse power systems. Silicone, ethylene propylene rubber and polyurethene were tested, but most of the data is for silicone. The particular power system developed uses a formed silicone insulator 76 cm in dia. and 3 mm thick as the major insulator between capacitors, railgap switches, load, and return conductor. The capacitor array is dc charged to 50 kv. The use of an elastomer dielectric made possible the construction of a pulser one order of magnitude smaller than previously constructed pulsers having the same current characteristics. Also, use of the elastomer dielectrics in pulse power systems leads to improved production techniques and system reliability. DOE

N81-18311# California Univ., Livermore. Lawrence Livermore Lab.
BASIC PRINCIPLES GOVERING THE DESIGN OF MAGNETIC SWITCHES
D. L. Birx 18 Nov. 1980 26 p refs
(Contract W-7405-eng-48)
(UCID-18831) Avail: NTIS HC A03/MF A01

The idea of using saturable reactors as the basis of high power pulse generators is not a new concept, but there have been few recent applications of this technology. Here the principle of magnetic pulse generation is briefly described and some of the basic guidelines used to design these circuits are discussed. A demonstration of the principles by a small scale pulse amplifier is presented, and finally there is an extrapolation to a large scale system. DOE

N81-18312 *Iowa Univ., Iowa City.*
DIGITAL MODELING OF SYNCHRONOUS MACHINES FOR TRANSIENT STABILITY STUDIES Ph.D. Thesis
Kamran Behnam-Guilani 1980 116 p
Avail: Univ. Microfilms Order No. 8103431

Efficient simulation methods for accurate computer representation of synchronous machines in power system transient stability studies are considered. There are a number of models that could be used to estimate the dynamic performance of synchronous machines. In selecting a model in a transient stability study, the trade-off is between accuracy versus computational cost. Detailed examples of the agreements and disagreements between two of these models (simple and complex) are given. A criterion that could be used to determine the proper model (simple or complex) to be used to represent each synchronous machine is developed. The choice is based on fault location, clearing time, parameters, and initial loading of each machine. The study also described how a combination of models could be used to improve the efficiency of the simulation. Dissert. Abstr.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N81-18313 California Inst. of Tech., Pasadena.
DEVELOPMENT OF FINITE ELEMENT PROCEDURES FOR FLUID-STRUCTURE INTERACTION Ph.D. Thesis
Wing Kam Liu 1981 231 p
Avail: Univ. Microfilms Order No. 8104670

The development of finite element procedures for fluid structure interaction problems is presented. The areas upon which attention is focused are: numerical transient algorithms which emphasize implicit explicit finite element concepts; finite element kinematical descriptions for modelling fluid subdomains in fluid structure interaction problems; finite element methodology for nearly incompressible fluid and solid, and beam, plate and shell structures based upon theories which include transverse shear deformations; and finite rotation effects in numerical integration of rate constitutive equations arising in large deformation analysis. All these nonlinear methodologies are integrated into a working finite element computer code. A number of numerical examples are presented to demonstrate the effectiveness of these approaches. Dissert. Abstr.

N81-18314 Houston Univ., Tex.
OIL GANGLION DYNAMICS IN FLOW THROUGH POROUS MEDIA Ph.D. Thesis
Ka Ming Ng 1980 196 p
Avail: Univ. Microfilms Order No. 8103612

A model is formulated to study the transient behavior of oil ganglion populations during immiscible displacement in oil recovery processes. The model is composed of three components: a suitable model for granular porous media; a stochastic simulation method capable of predicting the fate of solitary ganglia and two coupled population balance equations for studying the dynamics of oil ganglion populations. The porous medium model proposed is a network of interconnected unit cells of the constricted tube type. The permeability of this model is determined by both the statistical analysis the network analysis. It is demonstrated that fluids in different portions of a porous medium interact with one another. Two methods are used in the simulation of the motion of solitary ganglion. It is found that the velocity of an oil blob decreases as its viscosity increases. *Dissert. Abstr.*

N81-18315 Rensselaer Polytechnic Inst., Troy, N. Y.
***FLOW REGIME IDENTIFICATION AND VOID FRACTION* MEASUREMENT TECHNIQUES IN TWO-PHASE FLOW Ph.D. Thesis**
Mark Andrew Vince 1980 566 p
Avail: Univ. Microfilms Order No. 8103765

Flow regime identification and void fraction measurement are considered in vertical two phase flow. A series of chordal void fraction measurements were made and formed into the probability density function and power spectral density function. The first four moments associated with these distributions were studied to obtain objective flow regime indicator. The PDF variance, or second moment about the mean, was found to be the best indicator of flow regime. A dual beam X-ray system was designed and constructed to make the chordal void fraction measurement required. This X-ray system employs a dc excited tube filament, full wave rectification and voltage filtering to produce a stable photon source. The large photon flux made analog linearization of the signal possible. Local void fraction measurements were made with a Karlsruhe impedance probe.

Dissert. Abstr.

N81-18316 State Univ. of New York at Buffalo, Amherst.
ANALYSIS OF STATIC AND DYNAMIC ELECTRIC ARCS *IN SUPERSONIC NOZZLE FLOW* Ph.D. Thesis
Chandra Kumar Bhansali 1980 263 p
Avail: Univ. Microfilms Order No. 8104172

An analysis of static and dynamic arcs subjected to supersonic

flow of argon in a converging-diverging nozzle is presented. The governing equations of the conservation of mass, momentum and energy are solved numerically. An explict, two-step, Law-Wendroff type second order accurate finite difference method employing the concept of time splitting is used for numerical solutions of these highly nonlinear partial differential equations. The time dependent approach is used for the solution of the steady state problem. Real gas properties are used and effects of optically thin radiation and turbulence are incorporated. The steady state solutions are obtained for a constant current of 700A, the arc being placed within a converging-diverging nozzle of 1 cm throat diameter operating under a stagnation pressure of 10 atm. Arc operation under the above steady-state conditions is assumed to be the initial state for the dynamic arc, which is subjected to a time varying linear current ramp with dI/dt = -50A microseconds. Dissert. Abstr.

N81-18317 Purdue Univ., Lafayette, Ind.
THE STUDY OF THE RHEOLOGICAL PROPERTIES OF POLYMERIC SOLUTIONS IN STEADY FLOW USING A SLIT RHEOMETER Ph.D. Thesis
Robert Michael Ybarra 1980 387 p
Avail: Univ. Microfilms Order No. 8102725

A functional dependence of exit pressure on wall shear stress was developed for viscoelastic fluids. In the limit of low Reynolds number, a quadratic dependence of exit pressure was postulated that resulted in a simple expression for the primary normal stress difference in terms of exit pressure N sub 1 = 3 p supp (HL). Data on four theologically different fluids confirmed the quadratic dependence on p supp (HL) on tau sub W at low shears. At high Reynolds numbers where inertial terms are dominant, N sub 1 was estimated using momentum equations. For highly elastic fluids and fluids whose inertia was too low to produce a jet with measurable thrust, slit flow also permitted estimation of N sub 1. Thus, the use of a slit rheometer offers potential for evaluating normal stresses over a much wider range of shear rates than previously thought. Dissert. Abstr.

N81-18318 Tennessee Univ., Knoxville.
FLUID-DYNAMIC AND AEROACOUSTIC INVESTIGATIONS OF SHROUDED JETS Ph.D. Thesis
Venugopal Veerasamy 1980 214 p
Avail: Univ. Microfilms Order No. 8104629

The fluid dynamic and aeroacoustic characteristics of a high subsonic jet discharging from a shrouded nozzle were investigated theoretically and experimentally to explore the possibility of jet noise reduction and thrust augmentation for STOL/VTOL aircraft. The preliminary design calculations of an adiabatic shrouded nozzle were performed by solving iteratively the one dimensional fluid dynamic equations governing the compressible flow. A two dimensional flow model, consisting of second order partial differential equations of a parabolic type, was used to find the effect of shroud length on the ejector performance. This model consists of the conservation laws with thin shear layer assumptions incorporating the Prandtl's mixing length hypothesis for turbuence closure. A numerical integration method was used to solve the governing fluid dynamic equations of motion. The aeroacoustic characteristics of the shrouded jet were analyzed based on the Lighthill's V(8) law. Dissert. Abstr.

N81-18319*# Florida State Univ., Gainesville.
VELOCITY FIELD NEAR THE JET ORIFICE OF A ROUND JET IN A CROSSFLOW
Richard L. Fearn and J. Paul Benson Dec. 1979 72 p refs (Grants NsG-2288; NGL-10-005-127)
(NASA-CR-152293) Avail: NTIS HC A04/MF A01 CSCL 20D

Experimentally determined velocities at selected locations near the jet orifice are presented and analyzed for a round jet in crossflow. Jet-to-crossflow velocity ratios of four and eight were studied experimentally for a round subsonic jet of air exhausting perpendicularly through a flat plate into a subsonic crosswind of the same temperature. Velocity measurements were made in cross sections to the jet plume located from one to four jet diameters from the orifice. Jet centerline and vortex properties are presented and utilized to extend the results of a previous study into the region close to the jet orifice. Author

N81-18320*# National Aeronautics and Space Administration, Washington, D. C.
HYDRODYNAMIC ROLE OF FISH SQUAMOSAL INTEGUMENT AS AN ANALOG OF THE SURFACES DIRECTLY FORMED BY THE TURBULENT FLOW. REPORT 2: HYDRODYNAMIC FUNCTION OF SQUAMOSAL INTEGUMENT
A. F. Kudryashov and V. V. Barsukov Dec. 1980 22 p refs Transl. into ENGLISH from Zool. Zh. (USSR), v. 46, no. 4, 1967 p 556-566 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75400) Avail: NTIS HC A02/MF A01 CSCL 20D

The stream flowing round the slowly swimming squama free fish can be laminized with the aid of the external slime coat alone. The slime of the fish with well developed squamae can laminize the stream together with the squamatic integument. Adjustments preventing a loss of the slime during laminization are better developed in the fastest squama free fishes. Author

N81-18321*# National Aeronautics and Space Administration, Washington, D. C.
BOUNDARY LAYERS AND RESISTANCE ON LIQUID MOTION WITH ONLY SLIGHT FRICTION
Apr. 1980 13 p refs Transl. into ENGLISH from conf. paper "Grenzschicten und Widerstand: Ueber Fluessigkeitsbewegung Bei Sehr Kleiner Reibung", 1904 p 484-491 Presented at the 3rd Intern. Math. Congr., Heidelberg, 1904; Leipsig, 1905; and Teubner, 1905 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75815) Avail: NTIS HC A02/MF A01 CSCL 20D

The laws of fluid motion are examined systemtically for the case where friction is assumed to be very slight. Calculations are carried out with the appropriate differential equation and practical investigations are illustrated. Author

N81-18322# Centre Technique des Industries Mecaniques, Senlis (France).
FLOW IN BENT PIPES Final Report [ECOULEMENT DANS LES CONDUITES COUDES]
Michel Pluviose Mar. 1980 21 p refs In FRENCH
(CETIM-14.F.091) Avail: NTIS HC A02/MF A01

The aerodynamic characteristics of a bent pipe were studied in an effort to improve the performance of high pressure gas turbines and to increase the reliability of the bent sections with regards to erosion/corrosion. Classic measurements of pressure distribution and energy dissipation were obtained using a water anemometer. Normal bends, laminar bends, elliptic bends, vaned bends, and bends with variable curvature were studied. Flow visualization by water injection shows that (1) the optimum medium line of the bend is circular; (2) losses are weakest when the straight line section reamins constant upstream and downstream of the bend; and (3) losses are very weak when the chosen straight line section is elliptic. According to the complexity of the circuit it can be of interest either to maintain elliptical pipes, or to supply the circuit with a transformation part, permitting return to a circular straight line section.
Transl. by A.R.H.

N81-18323# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SHOCK-BOUNDARY LAYER INTERACTION IN TURBOMACHINES, VOLUME 1
1980 298 p refs Proceedings of 1980 Lecture Ser., Rhode-Saint-Genese, Belgium, 2-6 Jun. 1980 2 Vol.
(VKI-LS-1980-8-Vol-1) Avail: NTIS HC A13/MF A01

Topics include physical and numerical aspects of shock boundary layer interactions, the influence of free stream Mach number on transonic interactions, discussions of measurement techniques, and For individual titles, see N81-18324 through N81-18327.

N81-18324# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
PHYSICAL AND NUMERICAL ASPECTS OF SHOCK

BOUNDARY LAYER INTERACTIONS
Marc Brusseleers *In its* Shock-Boundary Layer Interaction in Turbomachines, Vol. 1 1980 131 p refs (For primary document *see N81-18323 09-34)*
Avail: NTIS HC A13/MF A01

The properties of shocks and boundary layers, their basic *interactions, test methods, flow structures and shock patterns* for both oblique and normal shock interactions, correlations, and flows around airfoils are reviewed. Available calculation methods *are described, including discontinuity analysis,* boundary layer integral methods, multideck methods for modeling the detailed flow structure, and solution of the interaction problem using the Navier-Stokes equations. Author (ESA)

N81-18325# *National Aerospace Lab., Amsterdam (Netherlands).* Flight Div.
INFLUENCE OF FREE-STREAM MACH NUMBER ON *TRANSONIC SHOCK-WAVE BOUNDARY-LAYER INTERACTION*
J. W. Kooi *In* Von Karman Inst. for Fluid Dyn. Shock Boundary *Layer Interaction in Turbomachines, Vol. 1 1980* 37 p *refs* Also presented at DGLR/GARTEUR 6 Symp. on Transonic Configuration, Bad Harzburg, West Germany, 13-15 Jun. 1978 (For primary document see N81-18323 09-34)
(NLR-MP-78013-U) Avail: NTIS HC A13/MF A01

An experiment in which a nominal normal shock impinges on a turbulent flat plate boundary layer is described. The wall pressure distribution in the interaction region was measured for Mach number (1.40, 1.44, and 1.46) in front of the shock. The Reynolds number based on shock position was 18 million and based on momentum thichness at the start of the interaction it was 20,000. *At all Mach numbers detailed pitot and static pressure* surveys were made. The velocity profiles were integrated to give the integral properties whereas the skin friction was derived *from Clauser plots. Increasing the Mach number* results in a rapid growth of the separation bubble accompanied with the development of a supersonic tongue. A comparison with other data suggests that the Reynolds number also has a pronounced effect on the length of the separation bubble. Author (ESA)

N81-18326# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MODERN MEASUREMENT TECHNIQUES IN SHOCK BOUNDARY LAYER INTERACTIONS
Jean Delery *In* Von Karman Inst. for Fluid Dyn. Shock Boundary Layer Interaction in Turbomachines, Vol. 1 1980 74 p refs (For primary document see N81-18323 09-34)
Avail: NTIS HC A13/MF A01

The use of holographic interferometry and velocimetry to study high speed flows is reviewed. Zero order interferograms and their application to axisymmetric flows are illustrated. The Mach-Zehnder and holographic interferometer are described. Real time and double exposure interferometry as well as the data processing techniques used are discussed. The reference beam laser doppler velocimeter system and dual scatter system are illustrated. Determination of flow direction using optical frequency shifting devices, and the measurement of two velocity components with a two color laser velocimeter are shown. Data reduction procedures are discussed. Error sources, including particle lag and statistical errors are identified. Author (ESA)

N81-18327# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SOME FEATURES OF TRANSONIC SHOCK WAVE TURBULENT BOUNDARY LAYER INTERACTION
Jean Delery *In* Von Karman Inst. for Fluid Dyn. Shock Boundary Layer Interaction in Turbomachines, Vol. 1 1980 50 p refs (For primary document see N81-18323 09-34)
Avail: NTIS HC A13/MF A01

Physical features of shock wave turbulent boundary layer interaction phenomena in two dimensional steady transonic flows are reviewed. The influence of interaction phenomena on wall pressure distributions in a sonic throat of adjustable cross section is discussed. The effects of a shock wave on the boundary layer, including an increase in boundary layer thickness and rapid variation of the incompressible shape parameter are shown, using laser doppler velocimeter data. Calculation of the flow field using discontinuity analysis is illustrated and applied to examples of *supercritical airfoils. Methods for predicting the onset of separation* using boundary layer equations in the interaction domain are shown to agree with theory. Experimental data on flow structure, *resulting from interactions in a large separated region,* and the streamwise mean velocity profiles are examined. A phenomenological representation of turbulence properties in a large shock induced flow is given. Author (ESA)

N81-18328# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SHOCK-BOUNDARY LAYER INTERACTION IN TURBOMA-*CHINES, VOLUME 2*
1980 307 p refs Proceedings of 1980 Lecture Ser., Rhode-Saint-Genese, Belgium, 2-6 Jun. 1980 2 Vol.
(VKI-LS-1980-8-Vol-2) Avail: NTIS HC A14/MF A01

Topics include use of finite difference methods for solving boundary layer equations, calculation of viscous-inviscid transonic flows, geometric methods in computational fluid dynamics and computation of transonic flows in cascades. Also discussed are physical and For individual titles, see N81-18329 through N81-18332.

N81-18329# *Centre d'Etudes Aerodynamiques et Thermiques,* Poitiers (France).
SOLUTION, BY FINITE DIFFERENCES, OF THE BOUNDARY LAYER EQUATIONS IN A SHOCK BOUNDARY LAYER INTERACTION
P. Ardonceau *In* Von Karman Inst. for Fluid Dyn. Shock-Boundary Layer Interaction in Turbomachines, Vol. 2 1980 37 p refs (For primary document see N81-18328 09-34)
Avail: NTIS HC A14/MF A01

The rational formulation of the interacting boundary layer through the asymptotic behavior of the Navier-Stokes (NS) equations at large Reynolds number is presented. The classical Prandtl equations are found to be the first term of the asymptotic solution of the NS equations in viscous regions. The corresponding inviscid equations are the Euler equations that properly describe the flow with the exception of the thin viscous layer near the wall. The matching relations between the viscous layer and the inviscid flow are derived. The finite difference computation of the boundary layer is discussed. General features are described and problems relevant to the strong interaction regime are reviewed, i.e., existence of solution and computation of separation bubbles. A description of some algorithms to compute the matched viscous inviscid solution, is given. The parabolic boundary layer equations, when matched with the outer flow equation, even of hyperbolic type, lead to a boundary value problem. The definition of a numerical algorithm to efficiently converge the matched solution does not appear to be trivial. Author (ESA)

N81-18330# Naval Ship Research and Development Center, Bethesda, Md.
THEORETICAL CALCULATION OF VISCOUS-INVISCID TRANSONIC FLOWS
Tsze C. Tai *In* Von Karman Inst. for Fluid Dyn. Shock-Boundary Layer Interaction in Turbomachines, Vol. 2 1980 56 p refs (For primary document see N81-18328 09-34)
Avail: NTIS HC A14/MF A01

The status of computational methods for calculating viscous-inviscid transonic flows other than the solution of Navier-Stokes equations is presented. Techniques for solving transonic inviscid flows and compressible integral boundary layer methods are reviewed and systems for strong viscous-inviscid interactions are described. Generally, the transonic viscous-inviscid interaction is characterized by a subcritical boundary layer with a supersonic outer stream. The thickening boundary layer produces a pressure rise which causes further thickening of the boundary layer. The physical flow is best modeled by direct coupling of the viscous and inviscid systems to allow immediate interaction between the shock wave and the boundary layer. It appears that the method of integral relations for the outer inviscid flow, combined with an integral boundary layer scheme, possesses such a compability. A hybrid approach to the transonic inviscid solution, which consists of the finite difference method for solving the overall transonic inviscid potential flow field and the method of integral relations for solving Euler's equation in the shock region, is suggested. Application of the steady two dimensional methods to the quasi two dimensional problem on the axisymmetric stream

surface of a cascade flow at transonic speeds is shown.
Author (ESA)

N81-18331*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GEOMETRIC METHODS IN COMPUTATIONAL FLUID DYNAMICS
Peter R. Eiseman *In* Von Karman Inst. for Fluid Dyn. Shock-Boundary Layer Interaction in Turbomachines, Vol. 2 1980 181 p refs (For primary document see N81-18328 09-34)
(Contracts NAS3-22117; NAS1-15810; AGARD-OTAN-DPP-80-11007)
Avail: NTIS HC A14/MF A01 CSCL 20D

General methods for the construction of geometric computational fluid dynamic algorithms are presented which simulate a variety of flow fields in various nontrivial regions. Included are: basic developments with tensors; various forms for the equations of motion; generalized numerical methods and boundary conditions; and methods for mesh generation to meet the strong geometric constraints of turbomachines. Coordinate generation is shown generally to yield mesh descriptions from one or more transformations that are smoothly joined together to form a composite mesh. Author (ESA)

N81-18332# GEC Power Engineering Ltd., Whetstone (England). Mechanical Engineering Lab.
COMPUTATION OF TRANSONIC CASCADE FLOWS WITH SHOCK AND BOUNDARY LAYER INTERACTION
U. K. Singh *In* Von Karman Inst. for Fluid Dyn. Shock-Boundary Layer Interaction in Turbomachines, Vol. 2 1980 31 p refs Sponsored by Ruston Gas Turbines Ltd., Lincoln, England (For primary document see N81-18328 09-34)
Avail: NTIS HC A14/MF A01

Viscous phenomena in transonic turbomachine blade flow calculations are represented superimposing the effects of a boundary layer and wake on a inviscid flow. The inviscid flow is determined using a time marching calculation method. The boundary layer calculation is developed to treat the interaction effects of shock and expansion waves. The boundary layer is also modified to account for the effects of collant flow ejection on the blade surface and the effects of blade surface curvature. The time marching method is then used to determine the surface Mach number distribution (including shock waves and the effects of coolant flow ejection) required for the blade surface boundary layer computation. The computed surface boundary layers and downstream wake are then applied to the basic profile producing a modified profile. Modification of the profile alters the external inviscid flow; successive iterations refine the interaction between the external and boundary layer flows until an equilibrium stage is attained. Laminar and turbulent surface boundary layers are calculated using integral boundary layer methods. The computation of a shock and boundary layer interaction effect using an integral method, is achieved by taking small meridional distance steps in the region of the shock and by assuming that the coefficient of skin friction is negligible if the boundary layer separates as a result of the interaction. The method is applied to flow through transonic axial turbine blade cascades, with good agreement with experimental data. Author (ESA)

N81-18333# Pennsylvania State Univ., University Park. Applied Research Lab.
EXPERIMENTAL VERIFICATION OF THE STREAMLINE CURVATURE NUMERICAL ANALYSIS METHOD APPLIED TO THE FLOW THROUGH AN AXIAL FLOW FAN
M. J. Pierzga 28 May 1980 142 p refs
(Contract N00024-79-C-6043)
(AD-A094422; ARL/PSU/TM-80-181) Avail: NTIS HC A07/MF A01 CSCL 20/4

To verify the results of a streamline curvature numerical analysis method, an investigation has been conducted in which comparisons are made between analytical and experimental data of an axial flow fan. Using loss model calculations to determine the proper outlet flow deviation angles, the flow field in the hub to tip plane of the turbomachine was calculated. These deviation angle calculations allow the inviscid streamline curvature (SLC) analysis to model a real fluid with viscous losses. The verification of this calculated flow field is the primary objective of the investigation; however, in addition to the hub to tip flow field, the numerical analysis of the blade-to-blade flow field was also investigated in some detail. To verify the accuracy of the numerical results, detailed flow surveys were conducted upstream and downstream of the test rotor of the axial flow fan. To obtain the necessary data to verify the blade-to-blade solution, internal blade row data were also collected. The internal blade row measurements were obtained by using a rotating circumferential traversing mechanism which was designed and implemented during this investigation. Along with these two sets of survey data, the static pressure distributions on the pressure and suction surfaces of the test rotor were also obtained. GRA

N81-18334# Colorado Univ. at Boulder. Dept. of Mechanical Engineering.
EFFECTIVE TECHNIQUES FOR AUGMENTING HEAT TRANSFER: AN APPLICATION OF ENTROPY GENERATION MINIMIZATION PRINCIPLES Final Report, 1 Oct. 1978 - 30 Sep. 1980
Adrian Bejan Dec. 1980 83 p refs
(Contract N00014-79-C-0006)
(AD-A094290; CUMER-80-9) Avail: NTIS HC A05/MF A01 CSCL 10/2

The techniques for heat transfer augmentation play an important role in the development of efficient and inexpensive equipment for heat exchange processes. In the present study, the effectiveness of a given augmentation technique was determined based on the amount of irreversibility (waste of useful energy) introduced by the technique into the heat exchanger where it is to be used. This report summarizes the main results obtained during the past two years under research contract N00014-79-C-0006 at the University of Colorado. The report is organized into three distinct parts. The first part contains a fundamental investigation of the entropy generation mechanism in elementary heat transfer configurations. The second part describes in quantitative terms the irreversibility minimization potential of some of the most common augmentation techniques, namely, swirl-flow devices and roughened surfaces. The final part considers the entropy generation penalty associated with the use of extended surfaces (fins) in convective heat transfer. This part shows how the fin geometry may be selected so that the fin performs its prescribed heat transfer duty with minimum generation of entropy. GRA

N81-18335# Sheffield Univ. (England).
INVESTIGATIONS OF EDDY COHERENCE IN JET FLOWS Interim Report
A. J. Yule Jun. 1980 29 p refs Presented at the Intern. Conf. on the Role of Coherent Struct. in Modelling Turbulence and Mixing, Madrid, 25-27 Jun. 1980 and at the 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif. 14-16 Jan. 1980 Sponsored in part by Army European Research Office
(Contract AF-AFOSR-3414-77; AF Proj. 2308)
(AD-A094394; AFOSR-81-0025TR; AIAA-80-0077) Avail: NTIS HC A03/MF A01 CSCL 20/4

In turbulent shear flow the term Coherent Structures refers to eddies which are both spatially coherent, i.e., large eddies, and also temporally coherent i.e., they retain their identities for times which are long compared with their time scales in fixed point measurements. In certain cases, for example transitional flows, the existence of such structures is evident from flow visualizations. However in many other flows, and in the complex flows usually found in practical situations, such structures are not so evident although an evaluation of the reasons for the existence of these two classes of flows is first given. Attention is then focused upon the more difficult flows, particularly the round turbulent jet, where coherent structures are not so evident, and upon techniques by which the existence (or non-existence) of such structures in these flows, can be established from point measurements, backed up by flow visualizations. A major problem is shown to be the need to discriminate between real losses in eddy coherent and apparent losses in coherence introduced by phase scrambling effects which smear multipoint correlations. The analysis of multiprobe time dependent data in cold and reacting round turbulent jets is described and it is shown how evidence of strong eddy coherence can be extracted from data in spite of small values of the classical statistical cross-correlations. GRA

N81-18336# Dynamics Technology, Inc., Torrance, Calif.
A NONLINEAR STABILITY THEORY FOR PLANE BOUNDARY-LAYER FLOWS
Toshi Kubota, Tony Chan, A. K. Liu, and Suphi Ozgur Jul. 1980 91 p refs
(Contract N00014-77-C-0005)
(AD-A094078; DT-7802-11) Avail: NTIS HC A05/MF A01 CSCL 20/4

A nonlinear stability theory for two-dimensional disturbances in plane boundary layers has been developed. The mathematical formulation and a discussion of the numerical method and results are presented. The basic assumptions made in the formulation are: the amplitude of disturbances is small, the rate of change of the undisturbed boundary layer with streamwise distance is small, and the rate of amplification of disturbances is small. The computation was checked against published results for plane Poiseuille flow and the Orr-Sommerfeld solutions for Blasius flow and a numerical solution of Navier-Stokes flow along a flat plate. The present theory agrees well with published results for these flow fields. GRA

N81-18337# Naval Postgraduate School, Monterey, Calif.
NUMERICAL SOLUTION OF STEADY AND PERIODICALLY PULSED TWO-DIMENSIONAL TURBULENT FREE JETS
Joseph C. Lai Apr. 1980 121 p refs
(AD-A094614) Avail: NTIS HC A06/MF A01 CSCL 20/4

The flow fields of a steady and a periodically pulsed two dimensional turbulent free jet have been studied by solving the thin shear layer equations by the Keller Box method in transformed variable form. A constant eddy-viscosity formulation was used to model the Reynolds shear stress term. For the steady jet, calculations agree well with documented experimental data. Computed results of the unsteady jet indicate that the mean flow characteristics follow closely those of the steady jet and compare well with available experimental data. For sufficiently high frequency and amplitude of pulsation or at large streamwise distance, significant unsteady effects occur in the instantaneous quantities. GRA

N81-18338# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
EXPERIMENTAL AND COMPUTATIONAL STUDIES OF HEAT TRANSFER IN COMPLEX INTERNAL FLOWS Summary Report, 15 Sep. 1979 - Dec. 1980
Ephriam M. Sparrow and S. V. Patankar Jan. 1981 130 p refs
(Contract N00014-79-C-0621; NR Proj. 097-437)
(AD-A094575; SR-1) Avail: NTIS HC A07/MF A01 CSCL 20/4

The details of five distinct pieces of research are set forth in this report. These research problems are interrelated in that they deal with various aspects of complex duct flows. Four of the research problems are experimental in nature. The first deals with the influence of plenum chamber geometry on the heat transfer and fluid flow characteristics in tubes situated downstream of the plenum. In the second experimental problem, the mixing of fluids of different temperatures in a tee is studied. The third experiment is focused on the fluid flow (without heat transfer) in arrays of longitudinal fins, while the last of the experiments treats a nonuniformly heated noncircular duct. The objective of the analytical work was to develop a turbulence model for rectangular passages, and one of the test cases for the model was to predict the friction factors that had been measured for the longitudinal fin arrays. GRA

N81-18339# South Carolina Univ., Columbia. Dept. of Mathematics and Statistics.
A LOWER BOUND FOR THE NORM OF THE SOLUTION OF A NONLINEAR VOLTERRA EQUATION IN ONE-DIMENSIONAL VISCOELASTICITY
Frederick Bloom 9 Dec. 1980 25 p refs
(Grant AF-AFOSR-3396-77; AF Proj. 2304)
(AD-A094560; AFOSR-81-0055TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

It is shown that the lower bound for the norm of sufficiently smooth solutions of initial history value problems associated with the nonlinear, one dimenstional model of viscoelastic response must grow quadratically in time on any interval where the norm of U is bounded from above. No sign definiteness restrictions are imposed on the derivatives on this model of nonlinear viscoelastic response. GRA

N81-18340# Texas A&M Univ., College Station. Dept. of Physics.
RELATIONSHIPS BETWEEN ELEMENTS OF THE STOKES MATRIX
Edward S. Fry and George W. Kattawar 16 Jan. 1981 15 p refs Submitted for publication
(Contract N00014-80-C-0113)
(AD-A094188; Rept-5) Avail: NTIS HC A02/MF A01 CSCL 20/4

Although there are sixteen elements of the Stokes Matrix, they are constructed from basically four amplitudes and three phase differences. This of course implies that there exists nine independent relationships connecting the elements. These relationships are equalities for scattering by a single particle in a fixed orientation and in a fixed direction. They become inequalities when Stokes matrices from an ensemble of particles differing in size, orientation, morphology, or optical properties are added incoherently. These relations will prove to be very useful for providing consistency checks on experimental measurements of all sixteen elements. GRA

N81-18341# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN OF LASER-GENERATED SHOCKWAVE EXPERIMENTS. AN APPROACH USING ANALYTIC MODELS
Y. T. Lee and R. J. Trainor 7 Nov. 1980 33 p refs Presented at the 22nd Ann. Meeting of the Div. of Plasma Phys. of the APS, San Diego, Calif., 10-14 Nov. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-84787; CONF-801119-2) Avail: NTIS HC A03/MF A01

Two of the target physics phenomena which must be understood before a clean experiment is performed are preheating due to suprathermal electrons and shock decay due to a shock rarefaction interactions. Analytic models are described for these two processes and the predictions of these models are compared with those of the LASNEX fluid physics code. This work was not with the view of surpassing or even approaching the reliability of the code calculations, but rather with the aim of providing models which are used for quick parameter sensitivity evaluations, while providing physical insight into the problems. DOE

N81-18342# Argonne National Lab., Ill.
METHODS FOR IMPROVING THE ACCURACY OF AIR FLOW MEASUREMENTS
J. Vresk Sep. 1980 27 p refs
(Contract W-31-109-eng-38)
(ANL/SDP-10; SOLAR/0908-80/70) Avail: NTIS HC A03/MF A01

Air flow measurement technology was reviewed, and instrumentation that can improve the accuracy of air flow measurements in solar energy systems is proposed and described. The accuracy that is achievable in such measurements was analyzed. Installation instructions are provided and the cost of replacing the single point flow sensing devices used at present with improved measuring instrumentation was estimated. DOE

N81-18343# Illinois Inst. of Tech., Chicago.
SOLIDS CIRCULATION AROUND A JET IN A FLUIDIZED BED GASIFIER Final Report, 1 Sep. 1978 - 30 Sep. 1980
Dimitri Gidaspow, Bozorg Ettehadieh, Chungliang Lin, Anil Goyal, and Robert W. Lyczkowski 1980 79 p refs
(Contract DE-FG21-78ET-12229; Grant ET-78-G-01-3381)
(DOE/ET-12229/T1) Avail: NTIS HC A05/MF A01

A hydrodynamic model to predict solids circulation around a jet in a fluidized bed gasifier was developed. To account for unequal velocities of solid and fluid phases, separate phase momentum balances were developed. Other fluid bed models used in the scale-up of gasifiers do not employ the principles of conservation of momentum. These models cannot predict fluid and particle motion. In such models solids mixing is described by means of empirical transfer coefficients. A two dimensional unsteady state computer code was developed to give gas and

solid velocities, void fractions and pressure in a fluid bed with a jet. The growth, propagation and collapse of bubbles was calculated. Time-averaged void fractions were calculated that showed an agreement with void fractions measured with a gamma ray densitometer. DOE

N81-18344# California Univ., Livermore. Lawrence Livermore Lab.

HEATING BY THE RAMAN INSTABILITY

Kent G. Estabrook and W. L. Kruer 1980 14 p refs Presented at the Anomalous Meeting, San Francisco, 28-30 May 1980 Submitted for publication

(Contract W-7405-eng-48)

(UCRL-84270-Rev-1; CONF-800550-1-Rev-1) Avail: NTIS HC A02/MF A01

Computer simulations are presented of the reflection and heating due to stimulated Raman backscatter of intense laser light in large regions of underdense plasma. The heated electron distribution is found to be approximately a Maxwellian of temperature approx. (m sub e/2)v sub p to the 2nd where v sub p is the phase velocity of the electron plasma wave. A simple model of the reflection is presented. Raman may cause a pre-heat problem with large laser fusion reactor targets. DOE

N81-18345# California Univ., Livermore. Lawrence Livermore Lab.

CONDUCTION HEAT TRANSFER SOLUTIONS

James H. VanSant Mar. 1980 558 p refs

(Contract W-7405-eng-48)

(UCRL-52863) Avail: NTIS HC A24/MF A01

A collection of solutions to a variety of heat conduction problems found in numerous publications, such as textbooks, handbooks, journals, reports, etc., are presented. Its purpose is to assemble these solutions into one source that can facilitate the search for a particular problem solution. Generally, it is intended to be a handbook on the subject of heat conduction. This material is useful for engineers, scientists, technologists, and designers of all disciplines, particularly those who design thermal systems or estimate temperatures and heat transfer rates in structures. More than 500 problem solutions and relevant data are tabulated for easy retrieval. There are twelve sections of solutions which correspond with the class of problems found in each. Geometry, state, boundary conditions, and other categories are used to classify the problems. A case number is assigned to each problem for cross referencing, and also for future reference. Each problem is concisely described by geometry and condition statements, and many times a descriptive sketch is also included. At least one source reference is given so that the user can review the methods used to derive the solutions. DOE

N81-18346# Levy (Salomon), Inc., Campbell, Calif.

ANALYSIS OF ANNULAR LIQUID-GAS FLOW WITH ENTRAINMENT: COCURRENT VERTICAL FLOW IN AN ANNULUS

S. Levy and J. M. Healzer Oct. 1980 60 p refs Sponsored by Electric Power Research Inst.

(EPRI Proj. 1380-1)

(EPRI-NP-1563) Avail: NTIS HC A04/MF A01

Two-phase (gas liquid) flow in complex geometries is of great importance to nuclear reactors. Predictions of the gas liquid velocity and distributions are lacking for such complex flow channels. Solutions were developed for gas liquid flow in an annulus where the inner and outer walls of the annulus are covered with wavy liquid films and are separated by a gas core. In agreement with experimental data, the solutions show and explain why most of the liquid is found on the outer wall of the annulus. DOE

N81-18347# Texas Univ. at Austin. Center for Energy Studies.

WATER-LITHIUM BROMIDE DOUBLE-EFFECT ABSORPTION COOLING ANALYSIS Final Report

G. C. Vliet, Michael B. Lawson, and Rudolfo A. Lithgow Dec. 1980 127 p refs

(Contract DE-AC03-79SF-10540)

(DOE/SF-10540/T1) Avail: NTIS HC A07/MF A01

A numerical model was developed for the transient simulation of the double-effect, water-lithium bromide absorption cooling machine and was used to determine the effect of the various design and input variables on the absorption unit performance. The performance parameters considered were coefficient of performance and cooling capacity. The variables considered include source hot water, cooling water, and chilled water temperatures; source hot water, cooling water, and chilled water flow rates; solution circulation rate; heat exchanger areas; pressure drop between evaporator and absorber; solution pump characteristics; and refrigerant flow control methods. The performance sensitivity study indicates that the distribution of heat exchanger area among the various (seven) heat exchange components is a very important design consideration. Moreover, it indicated that the method of flow control of the first effect refrigerant vapor through the second effect is a critical design feature when absorption units operate over a significant range of cooling capacity. The model was used to predict the performance of the Trane absorption unit with fairly good accuracy. DOE

N81-18348# Aeronautical Research Associates of Princeton, Inc., N. J.

A MODEL OF THE STRUCTURE OF HOMOGENEOUS TURBULENCE

Oct. 1980 23 p

(Contract F44620-76-C-0048)

(AD-A094431; AFOSR-81-0034TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

We propose to generalize well-known transport equations for turbulent flows so that they are assumed to apply to two-point correlation functions. We use analogy with their one-point counterparts to which they are required to reduce as the separation of the two points is made to vanish. In order to illustrate the development of this program, we concentrate in this report on homogeneous turbulence at high Reynolds numbers so that the two one-point models needed are the dissipation model and the redistribution model. Both models have been used successfully for such a long time that it is difficult to assign rigidly their originators. They have acquired special importance in the recent developments of turbulent transport calculations. GRA

N81-18349 Iowa Univ., Iowa City.

VISCOUS FLUID BUCKLING: A THEORETICAL AND EXPERIMENTAL ANALYSIS WITH EXTENSIONS TO GENERAL FLUID STABILITY Ph.D. Thesis

Joseph Odartey Cruickshank 1980 228 p

Avail: Univ. Microfilms Order No. 8103439

The spontaneous oscillations observed when a very viscous fluid flows from an orifice vertically against a flat surface were studied using silicone oils of very high viscosities as the main working fluids. The 'moving threadline' equation is shown to also govern the oscillations of the fluid column and it is suggested that certain conclusions reached in the study of the 'moving threadline' have direct application to the problem of fluid buckling. Results are presented in nondimensional form for the buckling height, the plate orifice distance at which the spontaneous oscillations first occur and the behavior of these oscillations as functions of geometrical fluid and flow properties for both axisymmetric and plate jets. Analytical solutions for the 'viscous gravity' jet profile are compared with the experimentally determined jet profile and with the numerically obtained solutions of the complete one dimensional equations (including inertia and surface tension). The existence of a 'jump' or discontinuity in the oscillations of the jet is postulated. Dissert. Abstr.

N81-18350 Stanford Univ., Calif.

A FLOW BUILT UNDER A STEP FUNCTION WITH A MULTI-STEP MARKOV PARTITION ON A BASE Ph.D. Thesis

Kyewon Koh Park 1980 45 p

Avail: Univ. Microfilms Order No. 8103544

It is proved that the flows built under step functions are dense in d-metric. Hence every flow can be approximated in distribution and entropy by flows, each being built under a step function with a multi-step Markov partition on a base. It is proved that a flow under a step function with a multi-step Markov partition on a base is a direct product of a Bernoulli flow with a rotation. D-closure of this class is shown to consist of all direct products of Bernoulli flows with flows of rational pure point spectrum w.r.t. some number. Specially Bernoulli flows

can be characterized as d-limits of Bernoulli flows in this class. It is demonstrated that a flow under a step function, whose values are independent over rationals, with a mixing Markov partition on a base is a Bernoulli type. But two nonisomorphic flows are also constructed (one is Bernoulli and the other is LB) under step functions, each having the property, that is values are independent over rationals, with the same Bernoulli partition on a base. It is also shown that every flow can be generated by three Bernoulli factors. Dissert. Abstr.

N81-18351 California Univ., Los Angeles.
A METHOD FOR COMPUTING THE INTERNAL WAVE FIELD AROUND A NONLINEAR STRATIFIED FLOW Ph.D. Thesis
Linda Kay Jaderberg 1980 342 p
Avail: Univ. Microfilms Order No. 8104003

A method is presented for computing the internal wave field that results from an initial perturbation to a density stratified fluid. The method is a hybrid of a linear analytic theory and a finite difference code which can represent nonlinear fluid flow. The resultant computer code is particularly adept at handling calculations of linear fluid flow around a nonlinear core: a situation that eventually arises from nearly every nonlinear stratified flow. The code requires very little interaction between its linear and nonlinear portions. This allows the linear portion of the code to escape the tedious time stepping that is largely responsible for the expense and inaccuracies of finite-difference codes. The theoretical analysis that forms the basis of the hybrid code's linear portion is presented. The analysis is carried out for the case of a two dimensional fluid plane with a band of uniform stratification surrounded by constant density fluid. Dissert. Abstr.

N81-18352 Alabama Univ., University.
PREDICTION OF PARTICLE PATHS FOR FLOW OF A GAS/SOLIDS SUSPENSION THROUGH A CASCADE OF FLAT PLATES Ph.D. Thesis
Leslie Crosby Hamer, Jr. 1980 239 p
Avail: Univ. Microfilms Order No. 8104072

The removal of particulate matter from gas/solids suspensions by the Louver separator was studied with emphasis on the importance of particle impingement on the elements of the separator. The governing equations for the flow field of the carrier gas were the continuity equation and the momentum equation. The flow field was assumed to be: (1) steady; (2) two dimensional; (3) irrotational; (4) incompressible. These assumptions assure the existence of a velocity potential and stream function which define the complex potential for the flow field, and which must satisfy the Cauchy-Riemann equations. The complex potential developed for the separator flow field was shown to satisfy the foregoing assumptions. Additionally, to ensure that the assumption of streamline flow was valid about the louver elements, the coefficient of lift for each case presented was less than that necessary to assure that flow separation does not occur. To determine the equations for the particle velocity and position within the flow field, Newton's second law of motion was utilized. Dissert. Abstr.

N81-18353 City Univ. of New York, N. Y.
LASER DOPPLER VELOCIMETRY STUDY OF THE ONSET OF CHAOS IN TAYLOR VORTEX FLOW Ph.D. Thesis
Philip Randolph Fenstermacher 1980 133 p
Avail: Univ. Microfilms Order No. 8103925

The laser Doppler velocimetry technique was used to study the mechanism by which chaos can appear in a system governed by deterministic equations of motion and time independent boundary conditions. Incompressible fluid flow between concentric cylinders, induced by the rotation of the inner one with the outer one fixed, was chosen because it displays a progression of instabilities with increasing Reynolds number before the onset of chaos. A minicomputer was used on line to a PDP-10 mainframe to acquire long data records. The computed velocity power spectral densities therefore had a resolution of (0.0001). High optical mixing efficiency provided a signal to noise ratio three orders of magnitude higher than previous studies. As a result, it was possible to precisely characterize a quasi-periodic flow and show that chaos appears after two time dependent instabilities. Relationships of the mode frequencies at the onset of chaos are examined. Dissert. Abstr.

N81-18354 Purdue Univ., Lafayette, Ind.
DETERMINATION OF TWO-PHASE FRICTION FACTORS FOR VOID FRACTION AND BOILING HEAT TRANSFER EVALUATION Ph.D. Thesis
Jentung Ku 1980 171 p
Avail: Univ. Microfilms Order No. 8102677

Visual and photographic observations of the boiling processes undergone by refrigerants in a cylindrical tube under both stationary and rotating conditions show that there are no bubbles generated for refrigerants heated on the tube surface. This indicates that the transfer of heat is always enhanced by increasing the centrifugal acceleration. The laminar flow in a cylindrical porous tube with uniform mass injection through the porous wall was studied both theoretically and experimentally. The full Navier-Stokes equations are solved numerically by employing some finite difference schemes. Solutions for velocity profiles and frictional pressure drops were obtained by the use of vorticity and stream function approach. An experimental apparatus for measuring velocity profiles and static pressure drops was set up which uses Pitot tubes to measure the velocities in terms of dynamic pressures. The device is sensitive to pressure differentials of 0.1 micron of water. Dissert. Abstr.

N81-18245# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COMMENTS ON TURBULENCE
Robert Legendre *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 1-7 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 77-83 Original report in FRENCH previously announced as A80-46226 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

N81-18248# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AN IMPLICIT FINITE VOLUME METHOD FOR ELLIPTICAL FLOW COMPUTATION
Denis Dutoya and Pierre-Jacques Michard *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 51-59 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 123-129 Original report in FRENCH previously announced as A80-46229 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

N81-18252# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CALCULATION OF UNSTEADY TURBULENT BOUNDARY LAYERS IN DIRECT OR INVERSE MODE, INCLUDING REVERSE FLOWS: ANALYSIS OF SINGULARITIES
Jean Cousteix, Jean-Claude LeBalleur, and Robert Houdeville *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 3-13 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 147-157 Original report in FRENCH previously announced as A80-43545 (For primary document see N81-18251 09-31)
Avail: NTIS HC A05/MF A01

N81-18256# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL COMPUTATION OF FLOWS WITH ROLLED-UP VORTEX SHEETS
Serge Huberson *In its* La Rech. Aerospatiale Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 57-63 refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 197-207 Original report in FRENCH previously announced as A80-43548 (For primary document see N81-18251 09-31)
Avail: NTIS HC A05/MF A01

N81-18258# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IMPROVEMENTS IN THE DETERMINATION OF CONVECTIVE TRANSFERS FROM INFRARED THERMOGRAPHY
Daniel L. Balageas and Dominique Ory *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980

p 73-79 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 213-219 Original report in FRENCH previously announced as A80-43550 (For primary document see N81-18251 09-31)
Avail: NTIS HC A05/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-18355*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF THE COMPARATIVE EFFECTIVENESS OF REGRESSION ANALYSIS AND MODIFICATIONS OF GRADIENT METHODS AS APPLIED TO THE PROBLEM OF THE DETECTION OF CONTOURS DURING MACHINE PROCESSING OF PHOTOGRAPHS OF THE SURFACE OF PLANETS
A. V. Agapov, B. I. Kolosov, S. T. Mosin, and A. G. Yeremeev Sep. 1980 24 p refs Transl. into ENGLISH of "Issledovanie sravnitelnoy effectivnosti regressionnogo analiza i modifikatsiy gradientnykh metodov primenitelno k probleme otyskaniya konturov pri mashinnoy obrabotke fotosnimkov poverkhnosti planet" Rept. Pr-329 Acad. of Sci. (USSR), Inst. of Space Research, Moscow, 1977 22 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-76207) Avail: NTIS HC A02/MF A01 CSCL 14E

Modifications of the gradient method and the regression approach, as applied to the detection of contours during computer processing of video information are considered. Some parameters of the adopted models are evaluated and, the comparative effectiveness of the indicated methods during the detection of the contours of sets is demonstrated by the computer processing of photographs of cotton fields and of a section of the surface of the Moon. A.R.H.

N81-18356# Ionomet Co., Waban, Mass.
AN ULTRASENSITIVE ELECTRON (SOFT X-RAY) SILVER HALIDE/CHALCOGENIDE NEGATIVE OR POSITIVE INORGANIC RESIST Annual Report, 10 Sep. 1979 - 15 Oct. 1980
Jerome M. Lavine 10 Nov. 1980 48 p refs
(Contract N00014-79-C-0788)
(AD-A093450; AR-1) Avail: NTIS HC A03/MF A01 CSCL 14/5

We have successfully Ag-photodoped As2S3 using photographic Ag derived from evaporated AgBr. The use of evaporated AgBr has resulted in a 1000-fold increase in speed. We have shown that evaporated AgBr has very high sensitivity in the deep UV (50 microJ/sq cm at 2600 Angstroms, at soft X-ray wavelengths (5 microJ/sq cm at 7 Angstrom) and confirmed the previously observed e-beam sensitivity of 10 to the minus 9th power coulombs/sq cm. We have shown the feasibility of using evaporated AgBr as the photon sensitive layer of a multi-year photoresist system for sub-micron lithography. GRA

N81-18357# Brookhaven National Lab., Upton, N. Y.
SIGNAL SHAPING AND TAIL CANCELLATION FOR GAS PROPORTIONAL DETECTORS AT HIGH COUNTING RATES
R. A. Boie, A. T. Hrischo (Laboratorie de l'Accelerateur Linesaire, Orsay, France), and P. Rehak Nov. 1980 8 p refs Presented at the 1980 Nucl. Sci. Symp., Orlando, Fla., 5-7 Nov. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28691; CONF-801103-36) Avail: NTIS HC A02/MF A01

A low noise, wide bandwidth preamplifier and signal processing filter were developed for high counting rate proportional counters. The filter consists of an eight pole Gaussian integrator with symmetrical weighting function and continuously variable shaping time, tau sub s, of 8 ns to 50 ns preceded by a second order pole/zero circuit which cancels the long tails of the chamber signals. The preamplifier is an optimized common base input design with 2 nsec rise time and an equivalent noise input charge of 2000 rms electrons, when connected to a chamber with 10 pF capacitance and at a filtering time, tau sub s, of 10 ns. DOE

N81-18358# Stanford Linear Accelerator Center, Calif.
TIME-OF-FLIGHT MEASUREMENTS
William B. Atwood Oct. 1980 42 p refs Presented at the SLAC Summer Inst., Stanford, Calif., 28 Jul. - 8 Aug. 1980
(Contract DE-AC09-76SF-00515)
(SLAC-PUB-2620) Avail: NTIS HC A03/MF A01

Time of flight measurements are used in high energy particle physics experiments to: (1) distinguish background from events; and (2) identify particle types. An example of background separation is shown. The reaction studied was e + p e prime + p prime + X where the e(p) stand for an initial and detected electron (proton) and X is a produced but undetected final state with a mass in the rho meson region. The relative time between the detection of an electron and a proton in two of the spectrometers in End Station A is plotted. Data for two different kinematic settings taken in the experiment are shown. The time resolution has been partially corrected for the various flight paths through the instruments and the difference in time resolutions between the two settings results mainly from the incompleteness of this correction. The signal height above the background depends on the time resolution, (DELTA) tau. The chance background is proportional to the product of the electron counting rate, the proton counting rate, and (DELTA) tau. DOE

N81-18359# Washington Univ., Seattle.
RECENT IMPROVEMENTS ON GENERATING VOLTMETERS
H. Fauska 1980 4 p refs Presented at Symp. of Northeastern Accelerator Personnel, Madison, Wis., 13 Oct. 1980
(Contract DE-AC06-76ER-01388)
(DOE/ER-01388/463) Avail: NTIS HC A02/MF A01

Design improvements in the method of readout are discussed. The shape of rotor and stator for the generating voltmeter is described. DOE

N81-18253# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DEVELOPMENT OF SURFACE TEMPERATURE FLUXMETERS
Joel Guernigou, Claude Indrigo, Yves Maisonneuve, and Pierre-Gerard Mentre *In its* La Rech. Aerospatiale, Bimonthly Bull. no. 1980-3 (ESA-TT-657) 1980 p 15-25 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 159-168 Original report in FRENCH previously announced as A80-43545 (For primary document see N81-18251 09-31)
Avail: NTIS HC A05/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-18360 British Broadcasting Corp., Kingswood (England).
INVESTIGATIONS ON THE USE OF A SEMICONDUCTOR LASER SOURCE FOR TRANSMISSION OF BASEBAND VIDEO OVER OPTICAL FIBRES
R. P. Ritchie Nov. 1980 8 p refs
(BBC-RD-1980/14) Avail: BBC, Kingswood Warren, Tadsworth, Surrey, England

Simple l.e.d. sources are not sufficiently linear for broadcast quality transmission of baseband video. Laser diodes have a much more linear region to their output characteristic. However, a major signal impairment is present in the form of modal distortion. This is introduced at fiber connectors, and is a property

of the coherence of the laser source. Although a laser or reduced coherence was used, modal distortion reduced the signal quality below the standards required for broadcast. Further reductions in modal distortion will be necessary before a baseband video link of broadcast quality can be realized. A.R.H.

N81-18361 Rochester Univ., N. Y.
SYNCHRONIZATION OF PULSES FROM MODE-LOCKED LASERS Ph.D. Thesis
George Treide Harvey 1980 195 p
Avail: Univ. Microfilms Order No. 8104309

The synchronization of mode locked lasers was investigated. Particular emphasis was given to the timing of the laser output pulses with respect to the radio frequency signal driving the mode locking elements in the laser cavity. Two types of mode locked lasers were considered: a CW 10 modulated mode locked argon ion laser; and a q switched active passive mode locked Nd:YAG laser. Theoretical models for the treatment of laser pulse synchronization in both types of lasers were also developed. Dissert. Abstr.

N81-18362 Stevens Inst. of Tech., Hoboken, N. J.
EVALUATION OF LASER RATE PARAMETERS FOR YA O3:Pr(+)-3 Ph.D. Thesis
Leo Horowitz 1979 151 p
Avail: Univ. Microfilms Order No. 8100852

The radiative lifetimes, quantum efficiencies and transition rates for multiphonon decay of excited energy levels of Pr(3+) grown substitutionally in the host crystal YA O3 were measured as a function of temperature so as to evaluate the feasibility of developing Pr(3+) as a four level laser operating in the visible. In addition the observed spectral intensities of radiative transitions and positions of some energy levels were compared to calculated values. The lifetime of the H-3(6) level (13 microsec. at 77 K) as a function of temperature was found using the infrared quantum counting technique. The lifetime of the P-3(0) level (3 microsec. at 77 K) and the lifetime of the P-3(1) level (20.7 microsec. at 77 K) as a function of temperature were also measured. The quantum efficiencies and transition rate as a function of temperature were measured for the P-3(1) yields P-3(0) nonradiative transition and the H-3(6) yields H-3(5) nonradiative transition. The transition rates were found to conform to earlier multiphoton theory and were found to depend only on the energy gap of the transition and the maximum Debye cutoff frequency of the YA O3. Dissert. Abstr.

N81-18363# Electronics Research Lab., Adelaide (Australia).
AN ASSESSMENT OF THE CROSSED PORRO PRISM RESONATOR
B. A. See, K. Fueloep, and R. Seymour Aug. 1980 35 p refs
(ERL-0162-TM; AR-002-041) Avail: NTIS HC A03/MF A01

Lasers with crossed porro prism resonators for military laser rangefinder and designator applications are studied. Properties of these devices are reviewed and advantages over normal mirror resonators are examined. The theory of operating is treated and the mechanical stability and other features of the laser are examined and compared to standard mirror resonators. S.F.

N81-18364# Electronics Research Lab., Adelaide (Australia).
THE PULSE TRANSMISSION MODE LASER
B. A. See Sep. 1980 27 p refs
(ERL-0167-TM; AR-002-051) Avail: NTIS HC A03/MF A01

The Pulse Transmission Mode (PTM) laser is examined as a possible laser for the Weapons Research Establishment Laser Depth Sounder system. The PTM laser offers a means of generating the short pulse required by the system but its output is limited by gain saturation to 40 millijoule. Author

N81-18365*# Colorado State Univ., Fort Collins. Dept. of Physics.
VELOCITY MEASUREMENTS BY LASER RESONANCE FLUORESCENCE Final Report
C. Y. She and W. M. Fairbank, Jr. 1980 24 p refs
(Grant NsG-2287)
(NASA-CR-163971) Avail: NTIS HC A02/MF A01 CSCL 20E

The photonburst correlation method was used to detect single atoms in a buffer gas. Real time flow velocity measurements with laser induced resonance fluorescence from single or multiple atoms was demonstrated and this method was investigated as a tool for wind tunnel flow measurement. Investigations show that single atoms and their real time diffusional motion on a buffer gas can be measured by resonance fluorescence. By averaging over many atoms, flow velocities up to 88 m/s were measured in a time of 0.5 sec. It is expected that higher flow speeds can be measured and that the measurement time can be reduced by a factor of 10 or more by careful experimental design. The method is clearly not ready for incorporation in high speed wind tunnels because it is not yet known whether the stray light level will be higher or lower, and it is not known what detection efficiency can be obtained in a wind tunnel situation. A.R.H.

N81-18366# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
InGaAsP QUARTERLY MATERIALS FOR NEAR INFRARED DETECTOR AND LASER APPLICATIONS Final Report, 1 Jan. 1977 - 29 Feb. 1980
N. Holonyak and G. E. Stillman Jun. 1980 64 p refs
(Contract N00014-77-C-0086; ARPA Order 3316)
(AD-A094277) Avail: NTIS HC A04/MF A01 CSCL 20/5

In this project we have been concerned with the liquid phase epitaxial (LPE) and vapor phase epitaxial (VPE) growth of this quaternary system. A number of the basic features of the LPE growth of InGaPAs on InP have been identified. InP-In sub 1-x Ga sub x P sub 1-2 As sub z heterostructure lasers and detectors have been constructed and have been studied. GRA

N81-18367# Naval Research Lab., Washington, D. C. Optical Sciences Div.
LASER ANNEALING OF REFRACTORY OHMIC CONTRACTS TO GaAs Progress Report
J. F. Giuliani, W. T. Anderson, Jr., A. Christou, and H. B. Dietrich 5 Feb. 1981 10 p refs
(AD-A094306; NRL-MR-4439) Avail: NTIS HC A02/MF A01 CSCL 20/5

Laser annealing has been successfully applied in producing low resistance ohmic contact to GaAs using refractory metallizations. These alloy systems include TiW, Ta, Mo, and Ni deposited on epitaxial Ge layers grown on (100) n type GaAs substrates. In some cases an N- layer obtained by ion implantation was present at the GaAs surface. Ohmic contact resistances of 1-5 X .0000001 omega-sq cm have been produced by laser annealing. These values compare favorably with the results obtained by thermal annealing. The refractory ohmic contacts reported here are intended to improve the reliability of devices operated under high-temperature and/or high-power conditions. GRA

N81-18368# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PHOTOLUMINESCENCE STUDY OF LASER INTERACTION WITH GaAs M.S. Thesis
James Melvin Heitman Dec. 1980 115 p refs
(AD-A094403; AFIT/GEO/PH/80-6) Avail: NTIS HC A06/MF A01 CSCL 20/2

A study was made on the effect of scanned CW laser radiation on the photoluminescence of virgin, VPE and ion-implanted GaAs. The samples were scanned at room temperature using an argon laser with a beam spot size of 25 microns and a beam dwell time of 1 msec. A flowing cover gas was found to be essential during scanning for beam powers near the damage threshold. The damage threshold was primarily a function of laser power and spot size; dwell time was of secondary importance. Photoluminescence data was taken at 5 K using argon laser excitation. Spectra from virgin samples scanned below the damage threshold was similar to that from unscanned samples. For VPE samples implanted at room temperature with Ge at a fluence of 1 times 10 to the 14 per cubic centimeter, approximately 5% of virgin material luminescence was recovered after laser annealing of both capped and uncapped samples. This is approximately the same percentage achieved after thermal annealing. However, no sign of Ge activation was seen in the laser annealed samples, even though activation was achieved using thermal annealing. Ellipsometry measurements showed that

the laser annealed samples had the same index of refraction as found in unimplanted material. GRA

N81-18369# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

INVESTIGATION OF LASER HEATING IN COMPONENTS WITH SHARP EDGES M.S. Thesis

James F. Berke Dec. 1980 130 p refs
(AD-A094401; AFIT/GEO/PH/80-3) Avail: NTIS
HC A07/MF A01 CSCL 20/13

Numerical results are presented for the approximate time-averaged power density dissipated on the surface of a highly conductive infinite wedge (of angle 90 deg) near the vicinity of the sharp edge. The numerical results are normalized so one may readily obtain results for varying incident wave frequencies. The angle of incidence of the incident radiation, Theta sub i (measured with respect to the surface normal of the wedge), is varied from 0 deg (normal incidence) to 90 deg (grazing incidence). In particular, numerical results for TE and TM polarization are presented for incident wavelengths of 3.8 and 10.6 micrometers. It is assumed that the power density absorbed (watts/sq m.) is all converted to heat density. To accept the validity of the results, an extensive check is made on an arbitrary (real) order Bessel function subroutine used in the equation necessary for the numerical calculations. General electromagnetic theory is also discussed and extended to the use in specific geometries. The geometries considered besides the wedge (though with no numerical results) are the parabolic cylinder and infinite cone. In conclusion, the numerical results seem very promising due to the success of verifying the Bessel function subroutine used in the calculations. GRA

N81-18370# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

A DISC-LOADED MICROWAVE GUIDE FOR LASER APPLICATIONS M.S. Thesis

Michael B. Tutin Dec. 1980 60 p refs
(AD-A094399; AFIT/GEP/PH/80D-11) Avail: NTIS
HC A04/MF A01 CSCL 20/5

A brass disc-loaded microwave cavity was built and the feasibility of using it as the pump for an argon ion laser was investigated. The cavity was 3 feet long and its insertion loss was measured to be 6.3 db. The voltage standing wave ratio for an empty cavity was found to be below 1.5 at all frequencies from 2425 MHz to 2475 MHz. A quartz laser tube was inserted in the microwave cavity and filled with .50 torr of argon. A uniform discharge was obtained with 180 W of input power, and a spectral analysis revealed that previously known laser transitions occurred in the discharge. A laser cavity was formed, and a 'fireball' was observed in the discharge. However, attempts to optimize the system to obtain lasing were not completed. It was concluded that improvements must be made to the cavity to decrease the insertion loss and to the power supply to more effectively couple power to the plasma. GRA

N81-18371# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

INVESTIGATION OF ELECTRON LOSS PROCESSES IN CO2/He/N2 ELECTRIC DISCHARGES M.S. Thesis

Greg R. Schneider Dec. 1980 76 p refs
(AD-A094398; AFIT/GEP/PH/80D-8) Avail: NTIS
HC A05/MF A01 CSCL 20/3

An investigation of electron loss processes in electron beam-sustained discharges of an atmospheric pressure gas mixture of 1/1.6/3, CO2/He/N2 in a closed-cycle flow loop was conducted. Steady-state analysis of the discharge current indicates that the discharge is dominated by electron-neutral attachment at rates of approximately 10 to the 6th power sec. minus 1 in the E/N range of 0.5-9 Townsend. Attempts to fit an analytic solution of the electron lifetime equation to the discharge current decay curves were inconclusive due to the slow fall-time of the electron gun relative to the current decay time. Changes in the discharge characteristics due to chemical reactions in the plasma were not significant. GRA

N81-18372# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

MULTIPULSE LASER ANNEALING OF SELENIUM IMPLANTED GaAs M.S. Thesis

Ricardo Antonio Contreras Dec. 1980 82 p refs
(AD-A094396; AFIT/GEO/PH/80D-5) Avail: NTIS
HC A05/MF A01 CSCL 20/5

GaAs implanted with 120 keV Se at a fluence of 10 to the 14th power ions/sq cm was laser annealed using .53 micrometers energy from a Q-switched, frequency doubled, Neodymium:YAG laser. The substrates were irradiated in air by either a single pulse or multipulse with an average energy density of 300 mj/sq cm per pulse. The pulse width (FWHM) was 15 ns. Optical reflectivity in the ultraviolet spectrum of 210 nm to 380 nm was used to evaluate the crystal-line structure. The relative crystalline damage versus depth profile was obtained and compared to that of an as-implanted sample. The depth profiling was accomplished using a chemical etch. Implanted samples annealed at 1, 2, 4, 8, and 12 pulses all showed a dramatic reduction of damage as compared to the as-implanted sample. However, the results of the two pulse anneal show the highest degree of recrystallization approaching that of a virgin sample. GRA

N81-18373# Columbia Univ., New York. Dept. of Chemistry.

PICOSECOND LASER STUDIES OF EXCITED STATE PROTON TRANSFER Final Report, 1 Sep. 1977 - 30 Sep. 1980

Kenneth B. Eisenthal 30 Sep. 1980 20 p refs
(Grant AF-AFOSR-3407-77; AF Proj. 2303)
(AD-A094391; AFOSR-81-0022TR) Avail: NTIS
HC A02/MF A01 CSCL 20/5

Picosecond laser techniques were both used and developed to obtain new information on ultrafast molecular processes in liquids. From these studies, primarily of organic molecules, were have gained insight into: the physical and chemical pathways by which excited state molecules dissipate their energy by proton and electron transfer phenomena, the nature of intermolecular motions (cage effects in chemical reactions) and intramolecular motions about methylene groups, photodissociation of excited molecules and energy relaxation in the fragments generated, e.g., diphenylcarbene, the photoionization and subsequent electron solvation dynamics of pyrene in alcohols. The information we have obtained has important implications in the photostability of dye lasers and polymer systems, the development of new lasers based on the generation of large excited state populations in transient species; and the general effects of intense lasers on materials. GRA

N81-18374# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Thermomechanics Branch.

EXPERIMENTS WITH A SUPERSONIC MULTI-CHANNEL RADIAL DIFFUSER Final Report

Siegfried H. Hasinger Sep. 1980 48 p refs
(AF Proj. 2307)
(AD-A094192; AFWAL-TR-80-3029) Avail: NTIS
HC A03/MF A01 CSCL 20/5

A supersonic radial flow diffuser of the type to be used for high energy radial flow lasers was investigated in cold flow experiments. The diffuser consisted of a multitude of small channels and it was the main purpose of the investigations to optimize the geometry of these channels. The nominal inlet Mach number of the diffuser was 3.5 and its axial length to diameter ratio referred to the inlet was 0.5. The maximum pressure recovery rate obtained with this diffuser was 80% of normal shock recovery. Selected channels tested individually reached a recovery rate of over 100%. Failure of the diffuser as a whole to reach this performance must be attributed to flow instabilities triggered by flow irregularities inherent to the present radial flow system. GRA

N81-18375# Indiana Univ. at Bloomington. Dept. of Chemistry.

POWER STABILIZATION METHOD FOR A SYNCHRONOUSLY PUMPED DYE LASER SYSTEM Interim Technical Report

R. E. Russo, R. Withnell, and G. M. Hieftje 28 Jan. 1981
11 p refs Submitted for publication
(Contract N00014-76-C-0838; Grant NIH GM-24473; NR Proj. 051-622)
(AD-A094542; TR-33; Rept-41) Avail: NTIS

HC A02/MF A01 CSCL 20/5

The average power stability of the synchronously pumped dye laser can be improved by a factor of more than 5 by altering the optical feedback stabilization circuitry of the conventional laser system. Noise fluctuations in dye laser output power which normally occur are largely eliminated by changes in the pumping power of the ion laser. The slight loss in dye laser output power which is incurred by the beam splitter is largely offset by an increase in available ion laser power. GRA

N81-18376# Los Alamos Scientific Lab., N. Mex.
MULTIPLE-SHOT LASER DAMAGE THRESHOLDS OF ULTRAVIOLET REFLECTORS AT 248 AND 308 NANOMETERS
Stephen R. Foltyn and Brian L. Newman 1980 15 p refs Presented at the 12th Ann. Symp. on Opt. Mater. for High Power Lasers, Boulder, Colo., 30 Sep. - 1 Oct. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3429; CONF-8009119-1) Avail: NTIS HC A02/MF A01

Multiple shot damage thresholds of dielectric reflectors were measured at 248 and 308 nm. Standard irradiation conditions were a 10 ns pulsewidth, 0.6 nm spot diameter and 35 Hz pulse repetition frequency. The reflectors, from various sources, were composed of oxide and fluoride films. Although damage was generally initiated at visible film defects, there was no correlation between damage susceptibility and the appearance of these defects. At levels near threshold, damage was most often observed as an increase in white light scatter of a site with no growth upon continued irradiation; at higher levels, the damage site grew with successive shots. Test sites were subjected to at least 10 to the third power shots and some sites received as many as 2.5 x 10 to the fourth power shots; however, with only one exception damage was found to occur within the first few shots or not at all. Reflectors at 248 nm typically had damage thresholds in the 1.0 to 1.8 J/cu cm range with two samples exhibiting unexpectedly high threshold of 2.8 and 3.0 J/cu cm. In some cases, a subthreshold preirradiation treatment resulted in a 20 to 25% enhancement in damage resistance. DOE

N81-18377# Avco-Everett Research Lab., Mass.
OPTICALLY PUMPED METAL VAPOR LASERS Final Technical Report, 15 Apr. 1978 - 15 Jul. 1980
A. Mandl Sep. 1980 46 p refs
(DOE/DP-40008/1) Avail: NTIS HC A04/MF A01

The properties of optically excited Hg/NH3 and Hg/ND3 mixtures were studied as a function of mercury pressure in the range 1 to 40 torr. At low mercury pressures less than or equal to 1 torr, the well known uv emission band due to HgNH3 is dominant; this regime was investigated extensively over the past ten years. However, at higher pressures the uv band disappears and is replaced by a strong green emission band centered near 500 nm. From a detailed study of the spectral and temporal characteristics of the green band, it was concluded that it arises from the formation of the Hg2NH3 excited molecular complex. The lifetime of this exciplex was measured and was found to be 3.8 (MU) sec. Because of interest in the system as a potential energy storage laser medium, optical transmission measurements were carried out at selected wavelengths. Net absorption was observed across the green band at high mercury density, as well as in the uv band in the low density regime. DOE

N81-18378# Johns Hopkins Univ., Baltimore, Md. Dept. of Chemistry.
FAR INFRARED CHEMICAL LASERS Technical Progress Report, 1 Sep. 1979 - 31 Aug. 1980
Dean W. Robinson 1980 11 p refs
(Contract DE-AS02-76ER-02523)
(DOE/ER-02523/17; TPR-6) Avail: NTIS HC A02/MF A01

Some preliminary experiments in gas laser research are discussed. A new technique for measuring the linewidth of many high J,K rotational lines is presented. The method utilized the Stark effect on optically pumped molecular gas lasers. Formulas are given for calculating linewidths from experimentally measured electric field strengths. Pure rotational laser oscillation was observed in HF following flash photolysis of various mixtures of trifluoromethyl halide, acetylenic compound and argon in the ratio of 1:1:100. The intensities in these anomalously low rotational levels appear to be a function of the identity of the electronically excited halide (I^* or Br^*) produced photolytically. The observations of intense, amplified spontaneous emission on fifteen far infrared lines from flashlamp pumped H2O vapor in the 0.010 to 0.080 torr pressure range is described and explained. A mechanism based on direct optical pumping and collisional radistribution between resonance perturbed levels is presented. DOE

N81-18379# Los Alamos Scientific Lab., N. Mex.
RECENT STUDIES OF THE GAMMA-RAY LASER PROBLEM
George C. Baldwin, Laurie McNeil, Johndale C. Solem, and Bergen R. Suydam 1980 39 p Presented at the 11th Intern. Quantum Electron. Conf., Boston, 23 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1613; CONF-800614-3) Avail: NTIS HC A03/MF A01

The possibility of extending the laser principle into the hard X-ray region above a few keV depends upon the ability of a pump to create the critical density of population inversion for which gain overcomes loss by absorption. Although this critical density decreases with the wavelength of the radiation to be stimulated, the power required to generate it depends upon the lifetime of the state being pumped. Nuclear states have lifetimes ranging from fractions of picoseconds to millennia. In the so called recoilless or Mossbauer transitions of nuclear isomers, it was observed that the resonance cross section often exceeds the nonresonant absorption cross section by several orders of magnetide: just the condition for lasing in an inverted population. If, other things being equal, the absorber foil of a Mossbauer experiment contained an excess of excited states, then, instead of a Mossbauer experiment contained an excess of resonance, there would be an increase of intensity, and amplification by stimulated emission would be achieved. DOE

N81-18380# Midwest Research Inst., Golden, Colo. Photovoltaics Div.
SERI LASER SCANNER SYSTEM
Richard J. Matson and Theodore W. Cannon Oct. 1980 25 p
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/RR-612-733) Avail: NTIS HC A02/MF A01

A Laser Scanner System (LSS) produces a photoresponse map and can be used for the nondestructive detection of nonuniformities in the photoresponse of a semiconductor device. The photoresponse maps are used to identify solar cell faults including microcracks, metallization breaks, regions of poor contact between metallization and the underlying emitter surface and variations in emitter sheet resistance. The optical and electronic systems are reviewed, briefly discussing the significant items of each. DOE

N81-18381# Bechtel National, Inc., San Francisco, Calif.
CONCEPTUAL DESIGN OF A 1.5-MJ, 2-Hz KrF FUSION LASER SYSTEM
J. Caird, W. Allen, H. G. Hipkin, J. Benford (Physics International Co., San Leandro, Calif.), Y. G. Chen (Physics International Co., San Leandro, Calif.), D. Dakin (Physics International Co., San Leandro, Calif.), G. Frazier (Physics International Co., San Leandro, Calif.), T. Naff (Physics International Co., San Leandro, Calif.), T. S. T. Young (Physics International Co., San Leandro, Calif.), and M. R. Flannery (Hughes Aircraft Co., Los Angeles, Calif.) Dec. 1980 142 p refs
(Contract W-7405-eng-48)
(UCRL-53077) Avail: NTIS HC A07/MF A01

Electron beam pulsed power conditioning, optical system design, mechanical systems design, facilities, overall laser system efficiency, and capital costs are discussed. Overviews, design studies, technical analyses and summaries are included. DOE

N81-18382# California Univ., Livermore. Lawrence Livermore Lab.
GAIN SATURATION IN Nd:DOPED LASER MATERIALS
W. E. Martin and D. Milam 24 Sep. 1980 124 p refs
(Contract W-7405-ENG-48)
(UCID-18868) Avail: NTIS HC A06/MF A01

Gain saturation measurements on neodymium doped laser

materials is reported. Measurements at pulse durations of 1.0, 9.0, and 50 ns, and at 1064 nm and 1053 nm, were made on silicate, phosphate, and fluorophosphate glasses, and two crystalline materials, YAG and YLF. The measurement technique, calibrations, experimental cross checks, and errors are described in detail. The philosophy behind each aspect of the measurements are discussed, schematic diagrams of the experiment are shown, and supporting data is provided. DOE

N81-18383# California Univ., Livermore. Lawrence Livermore Lab.

DETERMINATION OF NEODYMIUM IN LASER GLASSES

Lester P. Rigdon and W. E. Sunderland 17 Nov. 1980 9 p refs

(Contract W-7405-eng-48)

(UCRL-53070) Avail: NTIS HC A02/MF A01

Procedures for determining neodymium as a minor constituent in a variety of laser glasses and special materials are described. In the usual procedure, samples are dissolved in mixtures of mineral acids; silica is removed by volatilization with fluoride; and some insoluble metal oxides and acids may be removed by centrifugation. Phosphate and gross quantities of alkali and alkaline earths and other elements are removed by precipitating Nd (III) with ammonium hydroxide or sodium hydroxide. The precipitate, containing neodymium along with the other elements precipitated by ammonia, is dissolved in perchloric acid solution. Neodymium is then determined by the absorption of light by Nd(III) at 795.5 nm. Few other elements in acid solution, only Dy(III), Er(III), and Tm(III), are known to interfere by absorbing light at this wavelength, and they are not commonly present in Nd-laser glasses. A list of laser glass materials that were assayed for neodymium and a list of interfering substances are given. DOE

N81-18384# Westinghouse Research and Development Center, Pittsburgh, Pa.

***OPERATIONAL CHARACTERISTICS OF 16 MICROMETER CO2 LASER* Final Technical Report, 1 Feb. 1977 - 30 Sep. 1980**

W. H. Kasner, D. W. Feldman, R. B. Feldman, D. R. Suhre, L. H. Taylor, G. L. Unger, and S. A. Wutzke Nov. 1980 190 p refs

(Contracts DE-AC04-77AL-03914; DE-AC04-78AL-14199; EY-77-C-04-3914)

(ALO-4199-1) Avail: NTIS HC A09/MF A01

The results of experimental and theoretical studies of the operational characteristics of a 16 micrometer CO2 bending mode laser are presented. Particular attention is given to determining the feasibility of using simple pulsed electrical discharges as an excitation source for this laser system. Emphasis is also given to: 16 micrometer laser emission; development of a computer model to explain the observed results and to predict behavior under other operating conditions; and development of a preliminary conceptual design for a deliverable laser system. DOE

N81-18385# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ANALYSIS OF DYE DEGRADATION EFFECTS ON OUTPUT ENERGY OF THE PULSED ORGANIC DYE LASER M.S. Thesis

Alan J. Bridging Dec. 1980 105 p refs

(AD-A094417; AFIT/GEP/PH/80D-1) Avail: NTIS HC A06/MF A01 CSCL 20/5

The dominant excitation and relaxation mechanisms found in dye molecules are discussed and then incorporated into a model for the xanthene dye laser. Rate equations for this model are presented which include terms that account for excited state singlet absorption and triplet absorption. The system of rate equations is solved using the steady rate approximation to derive equations for the threshold pump power and output power of the laser. The output power and threshold pump power equations are modified to include variables that allow the following effects of dye degradation to be examined: dye concentration reduction, reaction product absorption of pump radiation, reaction product absorption of lasing radiation, and singlet quenching by the reaction products. Theoretical values based on available experimental data are derived for these variables. A computer program is used to integrate the output power of the laser over the duration of a flashlamp pulse to compute the pulse energy. The energy decay curves computed using the theoretical data are presented and compared to the experimental pulse energy decay. GRA

N81-18386# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

LASER WAVE-FRONT ANALYZER SOFTWARE IMPROVEMENT M.S. Thesis

Robert C. Sudduth Dec. 1979 215 p refs

(AD-A094419; AFIT/GEO/PH/80-10) Avail: NTIS HC A10/MF A01 CSCL 20/5

A software package was written which will analyze annular shaped laser wave-fronts. This involved generating a set of orthogonal polynomials from the Zernike polynomials by using the Gram-Schmidt orthogonalization process. The coefficients of the polynomials are determined by using the orthogonality of the polynomials, instead of using the common least squares method. The coefficients of the generated polynomials are converted to Zernike coefficients and both sets of coefficients are presented to the user. By using the first moments of the wave-front's position in the collection array, the software is able to define the basic parameters of the wave-front. These parameters are: center, outside radius, and the obscuration ratio of the wave-front. With these parameters, the soft ware computes 6, then 11, then 22 coefficients to show the stability of the coefficients. With well defined circular and annular wave fronts, the program was consistently able to compute the coefficients with an RMS error of less than 0.050 waves. GRA

N81-18387# Army Missile Command, Redstone Arsenal, Ala.

DESIGN AND ANALYSIS OF AFOCAL, TWO-MIRROR SYSTEMS FOR ARBITRARY INTENSITY TRANSFORMATIONS

Walter LaVaughn Hales and Dietrich Korsch (TAI Corp.) Oct. 1980 96 p refs

(AD-A094439; AD-E950075; DRSMI/RH-81-2-TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

Generalized surface equations are developed for reflaxicon and waxicon systems which allow arbitrary control of the intensity profile of the exit beam. These equations assume axial symmetry of the intensity transformation function. Both the reflaxicon and waxicon systems are analyzed numerically to determine the sensitivity of the aberrations to system misalignment and system design parameters. Design recommendations are made for minimizing the sensitivity of the systems to misalignment. GRA

N81-18388 Johns Hopkins Univ., Baltimore, Md.

THE QUANTIUM OPTICS AND KINETICS OF OPTICALLY PUMPED MOLECULAR LASERS: EXPERIMENTAL OBSERVATIONS Ph.D. Thesis

Nabil Mishreky Lawandy 1980 145 p

Avail: Univ. Microfilms Order No. 802221

Experiments were performed on a variety of optically pumped gases to determine the effects of collisional interactions on the lasing process. The experiments included the use of buffer gases to determine relaxation mechanisms and heterodyne mixing techniques to study the effects of kinetics on the laser's emission characteristics. Dissert. Abstr.

N81-18389 State Univ. of New York at Buffalo.

STUDY OF THE MECHANISM OF DYE LASER INTRACAVITY ABSORPTION Ph.D. Thesis

Prem Kumar 1980 155 p

Avail: Univ. Microfilms Order No. 8104210

The process of intracavity absorption in a cw multimode dye laser is studied in an attempt to look for a possible mechanism of the process. The line shape of the signal observed by intracavity absorption is complex, consisting of both absorption and enhancement features. The detailed line shape depends upon the absorber density in the path of the laser and the total optical power in the laser cavity. In the high absorber density and low cavity power regime absorption feature is predominant, where as at low absorber density and high cavity power enhancement is observed. The absorber density and the cavity power dependence of the enhancement and the absorption features are experimentally determined. The line shape also depends upon the laser scan rate across the adsorption profile. The Super-Regen model seems successful in qualitatively predicting line shapes and the

time dependent behavior. When the laser is not wavelength scanned, spectral condensation and locking of the laser to the absorption line occurs. The enhancement signal is found to increase linearly with the absorber density at low densities, rises exponentially, and then saturates at the highest densities used.
Dissert. Abstr.

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-18390 *Iowa State Univ. of Science and Technology, Ames.*
LIQUID-LIQUID CHROMATOGRAPHY FRACTIONATION OF ORGANIC COMPOUNDS IN COMPLEX MIXTURES: APPLICATION TO AUTOMOBILE EXHAUST Ph.D. Thesis
Steven Gray Colgrove 1980 301 p
Avail: Univ. Microfilms Order No. 8103438

A liquid-liquid fractionation method based upon well known chemical reactions was developed. With the use of the fractionation method, a mixture of organic compounds was separated into strong acid, weak acid, base, aldehyde, ketone, polar, and nonpolar fractions. Organic compounds, representing several chemical classes, were used to determine how much material would be lost during the fractionation and to determine how well the various compound types could be separated from each other. Most of the compounds tested were recovered in yields which were sufficient to provide good qualitative and quantitative data. Problems relating to impurities introduced into samples by solvents and reagents were examined. In addition, some reactions which led to the formation of artifacts were investigated. The advantages of using the liquid-liquid fractionation method as a preseparation method for GC/MS were shown for the analysis of real samples including gasoline, diesel fuel, and exhaust from internal combustion engines using those fuels. Dissert. Abstr.

N81-18391*# National Aeronautics and Space Administration. *Lewis Research Center, Cleveland, Ohio.*
HISTORY OF BALL BEARINGS
Duncan Dowson (Leeds Univ., England) and Bernard J. Hamrock Feb. 1981 84 p refs
(NASA-TM-81689; E-209) Avail: NTIS HC A05/MF A01 CSCL 13I

The familiar precision rolling-element bearings of the twentieth century are products of exacting technology and sophisticated science. Their very effectiveness and basic simplicity of form may discourage further interest in their history and development. Yet the full story covers a large portion of recorded history and surprising evidence of an early recognition of the advantages of rolling motion over sliding action and progress toward the development of rolling-element bearings. The development of rolling-element bearings is followed from the earliest civilizations to the end of the eighteenth century. The influence of general technological developments, particularly those concerned with the movement of large building blocks, road transportation, instruments, water-raising equipment, and windmills are discussed, together with the emergence of studies of the nature of rolling friction and the impact of economic factors. By 1800 the essential features of ball and rolling-element bearings had emerged and it only remained for precision manufacture and mass production to confirm the value of these fascinating machine elements. Author

N81-18392*# National Aeronautics and Space Administration. *Lewis Research Center, Cleveland, Ohio.*
INTRODUCTION TO BALL BEARINGS
Bernard J. Hamrock and Duncan Dowson Feb. 1981 86 p refs
(NASA-TM-81690; E-209) Avail: NTIS HC A05/MF A01 CSCL 13I

The purpose of a ball bearing is to provide a relative positioning and rotational freedom while transmitting a load between two structures, usually a shaft and a housing. For high rotational speeds (e.g., in gyroscope ball bearings) the purpose can be expanded to include rotational freedom with practically no wear in the bearing. This condition can be achieved by separating the bearing parts with a coherent film of fluid known as an elastohydrodynamic film. This film can be maintained not only when the bearing carries the load on a shaft, but also when the bearing is preloaded to position the shaft to within micro- or nano-inch accuracy and stability. Background information on ball bearings is provided, different types of ball bearings and their geometry and kinematics are defined, bearing materials, manufacturing processes, and separators are discussed. It is assumed, for the purposes of analysis, that the bearing carries no load. Author

N81-18393# Centre Technique des Industries Mecaniques, Senlis (France).
TESTS OF DRILLING, BORING AND WIDENING WITH A CUTTER Final Report [ESSAIS DE PERCAGE, FORAGE ET AGRANDISSEMENTA LA LAME]
P. Lemaire 2 Oct. 1979 89 p In FRENCH
(CETIM-1.3D.02.0) Avail: NTIS HC A05/MF A01

Tests were conducted using various machine tools in order to complete or confirm industrial and bibliographic data gathered for the edition of a practical guide on drilling, boring and widening operations. The machine tools used, lubrications, and measurement methods employed are described. Results obtained using a spike cutter and various drill bits are analyzed. Transl. by A.R.H.

N81-18394# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 6: STATUS OF GAS BEARING TECHNOLOGY APPLICABLE TO AERO PROPULSION MACHINERY Interim Report, Jan. - May 1980
Coda H. T. Pan Wright-Patterson AFB, Ohio AFAPL Oct. 1980 107 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A094167; SRC-80-TR-57-Pt-6; AFAPL-TR-78-6-Pt-6)
Avail: NTIS HC A06/MF A01 CSCL 13/9

This report reviews gas lubrication technology as applicable to the support of aero propulsion equipment. It contains a historical sketch of the evolution of the field, a review of relevant fundamentals, a discussion of the whirl stability phenomena, the design of thrust bearings for turbomachines, a brief report on the current state of materials development, and a general review of gas lubricated compliant bearings. GRA

N81-18395# SKF Industries, Inc., King of Prussia, Pa.
ESTABLISHMENT OF ENGINEERING DESIGN DATA FOR HYBRID STEEL/CERAMIC BALL BEARINGS, PHASE 2 Final Report, Aug. 1979 - Aug. 1980
F. R. Morrison and T. Yonushonis 26 Sep. 1980 62 p refs
(Contract N00019-79-C-0418)
(AD-A094030; SKF-AT80T042) Avail: NTIS HC A04/MF A01 CSCL 11/6

A lot of hybrid ceramic/steel angular contact ball bearings was fabricated to a design optimized for operation at 2.5 x 10 to the 6th power dN. Life tests were conducted on these bearings at low speed, 0.4 x 10 to the 6th power dN, using two load levels which produced maximum Hertz stress levels of 2.0 GPa and 2.4 GPa respectively. A detailed failure analysis was completed to define the causes of the relatively early ball failures experienced at the high load and verify the good performance achieved at the low load. GRA

N81-18396# *Aerospace Corp., El Segundo, Calif.*
LIGHT-DUTY DIESEL ENGINE DEVELOPMENT STATUS AND ENGINE NEEDS
Aug. 1980 275 p
(Contract DE-AC03-78CS-52184)
(DOE/CS-52184/01) Avail: NTIS HC A12/MF A01

Research and development status of diesel engine technology applicable to light duty vehicles is discussed. In addition, specific basic and applied research and development needs in light-duty diesel technology are identified and related health areas where initial or increased participation by the US Government would be desirable are indicated. DOE

N81-18397# Technische Universitaet, Hanover (West Germany). Fakultaet fuer Mashinenwesen.
CLOSED-CYCLE GAS TURBINE IN FREQUENCY-EFFICIENCY OPERATION Ph.D. Thesis

Reinhard Krapp 15 Jan. 1980 140 p refs In GERMAN
(NP-25155) Avail: NTIS HC A07/MF A01

The frequency efficiency operation of a closed cycle gas turbine was studied. The requirements of the gas turbine for this operation and the possible control gearing with regard to its applicability for the frequency efficiency operation were investigated. Demonstrated on a reference plant, the suitable control methods were observed in a more detailed way. DOE

N81-18398# Department of Energy, Washington, D. C.
INTERNAL COMBUSTION ENGINES FOR ALCOHOL MOTOR FUELS: A COMPILATION OF BACKGROUND TECHNICAL INFORMATION
Nov. 1980 362 p refs
(DOE/AF-0001) Avail: NTIS HC A16/MF A01

This compilation, a draft training manual containing technical background information on internal combustion engines and alcohol motor fuel technologies, is presented in 3 parts. The first is a compilation of facts from the state of the art on internal combustion engine fuels and their characteristics and requisites and provides an overview of fuel sources, fuels technology and future projections for availability and alternatives. Part two compiles facts about alcohol chemistry, alcohol identification, production, and use, examines ethanol as spirit and as fuel, and provides an overview of modern evaluation of alcohols as motor fuels and of the characteristics of alcohol fuels. The final section compiles cross references on the handling and combustion of fuels for I.C. engines, presents basic evaluations of events leading to the use of alcohols as motor fuels, reviews current applications of alcohols as motor fuels, describes the formulation of alcohol fuels for engines and engine and fuel handling hardware modifications for using alcohol fuels, and introduces the multifuel engines concept. DOE

N81-18399# Rensselaer Polytechnic Inst., Troy, N. Y.
DEVELOPMENT AND QUALIFICATION OF METHODS FOR THE DETERMINATION OF DIFFUSIBLE HYDROGEN CONTENTS IN WELDMENTS Interim Technical Report, 1 Jul. 1977 - 30 Jun. 1980
W. F. Savage and E. F. Nippes 15 Sep. 1980 115 p refs
(Contract N00014-75-C-0944)
(AD-A094219; ITR-2) Avail: NTIS HC A06/MF A01 CSCL 13/8

Because a critical concentration of diffusible hydrogen must be present for hydrogen induced cracking, it is essential to determine the amount of hydrogen introduced by various welding procedures. This investigation involved the development and qualification of three methods for the determination of diffusible hydrogen content in weldments. (1) A hot extraction method utilizing a mass spectrometer: If a suitable quenching procedure were developed, the mass spectrometer extraction method could be used to measure the diffusible and total hydrogen contents of weld-metal specimens; (2) An electrochemical technique using a modification of the Barnacle Cell: The modified Barnacle Cell cannot be used to determine accurately the diffusible hydrogen content in weldments because accurate diffusivity values are not known, or are difficult to determine; (3) A silicone oil extraction method developed at RPI: This method is a reliable, rapid and inexpensive technique for the determination of diffusible hydrogen content in weldments. GRA

N81-18996*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEVELOPMENT OF A POLYMETRIC GROUT FOR THE HYDROSTATIC BEARING AT DSS 14
C. E. McClung (Monsanto Research Corp.), J. L. Schwendeman (Monsanto Research Corp.), G. L. Ball, III (Monsanto Research Corp.), G. H. Jenkins (Monsanto Research Corp.), R. D. Casperson, G. P. Gale, and A. A. Riewe *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 115-148 ref (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-18400*# Rockwell International Science Center, Thousand Oaks, Calif.
RESIDUAL SILICONE DETECTION Final Report, 13 Nov. 1979 - 12 Jul. 1980
T. Smith Dec. 1980 67 p refs
(Contract NAS8-33694)
(NASA-CR-161643; SC5252.8FR) Avail: NTIS HC A04/MF A01 CSCL 14D

Both photoelectron emission and ellipsometry proved successful in detecting silicone contamination on unpainted and epoxy painted metal surfaces such as those of the external tank and the solid rocket booster. Great success was achieved using photoelectron emission (PEE). Panels were deliberately contaminated to controlled levels and then mapped with PEE to reveal the areas and levels that were contaminated. The panels were then tested with regard to adhesive properties. Tapes were bonded over the contaminated and uncontaminated regions and the peel force was measured, or the contaminated panels were bonded (with CPR 483 foam) to uncontaminated panels and made into lap shear specimens. Other panels were bonded and made into wedge specimens for hydrothermal stress endurance tests. Strong adhesion resulted if the PEE signal fell within an acceptance window, but was poor outside the acceptance window. A prototype instrument is being prepared which can automatically be scanned over the external liquid hydrogen tank and identify those regions that are contaminated and will cause bond degradation. A.R.H.

N81-18401# Centre Technique des Industries Mecaniques, Senlis (France).
INTEGRATION OF NONDESTRUCTIVE TESTING IN FABRICATION (LARGE FORGINGS) [INTEGRATION DU CONTROLE NON DESTRUCTIF DANS LA FABRICATION (PIECES DE GROSSE FORGE)]
J. Rivenez and B. Bossuat 16 Jun. 1980 49 p In FRENCH
(CETIM-15.H.194; Rept-6) Avail: NTIS HC A03/MF A01

Common methods of automatic control such as sorting, marking, and signalling (by sound or light) are not entirely satisfactory for nondestructive testing in foundries. A simple solution involves processing the data obtained with an ordinary sonic machine. During control, under archival form, information is supplied relative to ultrasonic indication so that an operator can ulteriorly examine the defective or suspected defective piece. There is no need to establish a complete list of the maximum ultrasonic indications. Under automatic control, the transducer moves with a constant speed along a helical course traced on the part. It memorizes the data while the piece completes one rotation and compares these data to those from preceding revolutions. Transl. by A.R.H.

N81-18402# Electric Power Research Inst., Palo Alto, Calif.
NDE CHARACTERISTICS OF PIPE WELD DEFECTS
S. Wenk Sep. 1980 107 p refs Sponsored by EPRI
(EPRI-NP-1590-SR) Avail: NTIS HC A06/MF A01

Nondestructive examination evaluations depend on the interpretation of imagery obtained either from radiographic processes or as a result of recording of electronic signal waveforms. The interpretation process is aided by comparative imagery data for representative nuclear power plant piping. A pictorial comparison is presented of weld defect geometry with the companion radiographic and ultrasonic NDE results obtained for type 304 stainless steel, circumferential butt welds of 10 inch, schedule 80 piping. The defects were deliberately introduced into shop weldments for illustrative purposes. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-18403 Shock and Vibration Information Center (Defense), Washington, D. C. Shock and Vibration Information Center.
THE SHOCK AND VIBRATION DIGEST, VOLUME 12, NUMBER 11
Judith Nagle-Eshleman, ed. Nov. 1980 83 p refs
(AD-A092384) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set CSCL 20/1

Vibration and structural dynamics problems related to turbine rotors are addressed. Considerations significant to accurate analyses of blade vibrations are discussed. For individual titles, see N81-18404 through N81-18405.

N81-18404* Ohio State Univ., Columbus. Dept. of Engineering Mechanics.
VIBRATIONS OF TURBINE ENGINE BLADES BY SHELL ANALYSIS
In Shock and Vibration Information Center The Shock and Vibration Digest, V. 12, No. 11 Nov. 1980 p 3-10 refs (For primary document see N81-18403 09-39)
(Grant NAG3-36)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set CSCL 20/11

Several aspects are discussed which are pertinent to accurate analyses of blade vibration when the blades are modeled as shells. Two dimensional methods of analysis are developed and the characteristics of such analyses are summarized. R.C.T.

N81-18405 Akron Univ., Ohio. Dept. of Mechanical Engineering.
NONLINEAR ROTOR DYNAMICS ANALYSIS Final Report
M. L. Adams *In* Shock and Vibration Information Center The Shock and Vibration Digest, V. 12, No. 11 Nov. 1980 p 13-18 refs (For primary document see N81-18403 09-39)
Avail: NTIS Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20325; $15.00/set CSCL 20/11

A state of the art review is given of nonlinear rotor dynamics. Computerized simulation techniques are described which are shown to be computationally efficient. These techniques simulate transient and steady state system responses of complex multilinear effects. This computational capability is shown to be of great value in answering the increasing number of failure mode analysis questions. R.C.T.

N81-18406 Cornell Univ., Ithaca, N. Y.
COMPUTER-AIDED DESIGN OF CABLE REINFORCED MEMBRANE STRUCTURES Ph.D. Thesis
Robert Bruce Haber 1980 291 p
Avail: Univ. Microfilms Order No. 8102960

An integrated computer aided design system is presented which provides an effective tool for the design and analysis of membrane structures. There are three parts to the system corresponding to the main tasks in the design and analysis of membrane structures: mathematical surface representation; solution of the initial equilibrium problem; and large deformation analysis including slip between membranes and reinforcing cables. Interactive computer graphics programs are described for each part of the design system. A common data base permits the results from any part of the system to be used directly in later stages of design. Dissert. Abstr.

N81-18407 Washington Univ., St. Louis, Mo.
LATERAL TORSIONAL BUCKLING OF STEEL JOISTS AND JOIST SYSTEMS Ph.D. Thesis
Gholamhossein Masoumy 1980 211 p
Avail: Univ. Microfilms Order No. 8103714

Steel joist roof truss systems during construction, when the bridging lines are in place but before the permanent roofing provides full lateral stability, are considered. The lateral stability of a single truss is examined by treating the truss not as an equivalent beam but as a spatial assembly of laterally and torsionally restrained prismatic members. The results are compared with experimental data and previous analyses. The stability of a roof with multiple trusses connected laterally by bridging lines is then discussed. Various configurations are studied and general conclusions are given. Practical design recommendations regarding the design of the horizontal bridgings for roof systems based on the stability analysis are given. Dissert. Abstr.

N81-18408 State Univ. of New York at Buffalo, Amherst.
NONLINEAR ANALYSIS OF REINFORCED CONCRETE BEAMS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Etienne Wamba Tadjioguev 1980 244 p
Avail: Univ. Microfilms Order No. 8104243

A nonlinear analytical model was developed for the study of reinforced concrete beams through the entire range of monotonic loading, from zero to ultimate load. It used parabolic isoparametric two dimensional elements to represent the concrete, three-moded linear truss elements to represent the reinforcement and dimensionless bond elements to simulate the concrete steel interaction (bond). It includes the sources of material nonlinearities, namely progressive cracking, material anisotropy, bond, yielding of the reinforcement, and aggregate interlocking. Concrete is considered as a nonlinear orthotropic material in which the two moduli of elasticity in the two principal directions depend on the strain levels. Two example beams are analyzed using the developed model. One beam is selected from literature and has extensive experimental and analytical information for comparison purposes. The second beam was tested during the present investigation. Dissert. Abstr.

N81-18409 Alabama Univ., University.
FINITE ELEMENT ANALYSIS OF FRICTIONAL AXISYMMETRIC CONTACT STRESS PROBLEMS BY MEANS OF INCREMENTAL LOADING Ph.D. Thesis
Surawat Chaivirat 1980 198 p
Avail: Univ. Microfilms Order No. 8100562

The stress analysis of a threaded joint with axisymmetric loads is considered an axisymmetric contact stress problem. The stresses and displacements in frictional contact problems are loading-history-dependent. A solution method to determine the stresses and displacements for frictional contact of axisymmetric bodies is presented. A numerical solution technique is developed to analyze frictional contact of threaded joints. The axisymmetric finite element method is used. Bodies in contact are decomposed into smaller parts, some of which are identical. A simple static condensation is performed on each part of the bodies to reduce the number of unknown displacements. Multiple contact surfaces are possible. Contact forces are calculated by using the local flexibility equations of each pair of contact surfaces. Loads are applied incrementally and the solution is sought by means of iteration procedure for each load level. Dissert. Abstr.

N81-18410*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRUCTURAL TESTS ON SPACE SHUTTLE THERMAL PROTECTION SYSTEM CONSTRUCTED WITH NONDENSIFIED AND DENSIFIED LI 900 AND LI 2200 TILE
Jerry G. Williams Jan. 1981 45 p ref
(NASA-TM-81903) Avail: NTIS HC A03/MF A01 CSCL 20K

Structural tests were conducted on thermal protection systems (TPS) LI 900 and LI 2200 tiles and .41 cm and .23 cm thick strain isolation pads. The bond surface of selected tiles was densified to obtain improved strength. Four basic types of experiments were conducted including tension tests, substrate mismatch (initial imperfection) tests, tension loads eccentrically applied, and pressure loads applied rapidly to the tile top surface. A small initial imperfection mismatch (2.29 m spherical radius on the substrate) did not influence significantly the ultimate failure strength. Densification of the tile bond region improved the strength of TPS constructed both of LI 900 tile and of LI 2200 tile. Pressure shock conditions studied did not significantly affect the TPS strength. R.C.T.

N81-18411*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ROOM TEMPERATURE SHEAR PROPERTIES OF THE

STRAIN ISOLATOR PAD FOR THE SHUTTLE THERMAL PROTECTION SYSTEM
James Wayne Sawyer and William Allen Waters, Jr. Jan. 1981 40 p refs
(NASA-TM-81900) Avail: NTIS HC A03/MF A01 CSCL 20K

Tests were conducted at room temperature to determine the shear properties of the strain isolator pad (SIP) material used in the thermal protection system of the space shuttle. Tests were conducted on both the .23 cm and .41 cm thick SIP material in the virgin state and after fifty fully reversed shear cycles. The shear stress displacement relationships are highly nonlinear, exhibit large hysteresis effects, are dependent on material orientation, and have a large low modulus region near the zero stress level where small changes in stress can result in large displacements. The values at the higher stress levels generally increase with normal and shear force load conditioning. Normal forces applied during the shear tests reduces the low modulus region for the material. Shear test techniques which restrict the normal movement of the material give erroneous stress displacement results. However, small normal forces do not significantly effect the shear modulus for a given shear stress. Poisson's ratio values for the material are within the range of values for many common materials. The values are not constant but vary as a function of the stress level and the previous stress history of the material. Ultimate shear strengths of the .23 cm thick SIP are significantly higher than those obtained for the .41 cm thick SIP. E.D.K.

N81-18412*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A CRACK-CLOSURE MODEL FOR PREDICTING FATIGUE-CRACK GROWTH UNDER AIRCRAFT SPECTRUM LOADING
J. C. Newman, Jr. Jan. 1981 63 p refs
(NASA-TM-81941) Avail: NTIS HC A04/MF A01 CSCL 20K

The development and application of an analytical model of cycle crack growth is presented that includes the effects of crack closure. The model was used to correlate crack growth rates under constant amplitude loading and to predict crack growth under aircraft spectrum loading on 2219-T851 aluminum alloy sheet material. The predicted crack growth lives agreed well with experimental data. The ratio of predicted to experimental lives ranged from 0.66 to 1.48. These predictions were made using data from an ASTM E24.06.01 Round Robin. R.C.T.

N81-18413# Centre Technique des Industries Mecaniques, St. Etienne (France).
STRESS CONCENTRATIONS ON FLAT BOTTOMED GROOVES Final Report [CONCENTRATIONS DE CONTRAINTES GORGES A FONDPLAT]
P. Monnier Jun. 1980 55 p In FRENCH
(CETIM-11.C.10.1) Avail: NTIS HC A04/MF A01

Because of the number of planar pieces and shafts used in tools, determination of the stress concentration of flat bottom grooves is of importance. These grooves can be considered as the solution of the transition between a semicircular groove of one part and the shoulder of the other part. Photoelastic analysis of planar pieces is described and results are extrapolated for revolving parts. A finite element method is included, results are compared with those obtained experimentally and are verified with the aid of extensometers. A.R.H.

N81-18414# Centre Technique des Industries Mecaniques, Senlis (France).
TESTS WITH PRESSURE IMPULSES OF A METRIC IMPLEMENT FOR ISO COUPLINGS (TIGHTENERS BY ANNULAR JOINT ONLY) [ESSAIS AUX IMPULSIONS DE PRESSION D'UNE IMPLANTATION METRIQUE POUR RACCORDS ISO. (ETANCHEITE PAR JOINT TORIQUE SEULE)]
J. L. Lanier 23 Jun. 1980 18 p refs In FRENCH
(CETIM-14.J.221; Rept-2) Avail: NTIS HC A02/MF A01

A universal joining implement under standardization at ISO TC 131 must permit, without modification, four modes of tightness with hydraulic fittings. Tests were conducted at 500,000 cycles under 500 bar pressure pulse amplitude at 5 Hz frequency using Elf Acantis oil as the working fluid. Orifices of 22 by 150, 33 by 200, and 42 by 200 diameter were tested simultaneously on two steel blocks. No hydraulic fluid was leaked for the 22 by 150 diameter orifices during the complete test cycle. None was found for the 33 by 200 diameter orifices on one test block, although those on the second block had to be changed three times. The annular joints for the 42 by 200 diameter orifice had to be changed several times. Transl. by A.R.H.

N81-18415# Utah Univ., Salt Lake City.
THREE DIMENSIONAL STRESS FIELDS IN CRACKED PLATES Final Scientific Report
E. S. Folias Nov. 1980 147 p refs
(Contract F49620-77-C-0053; AF Proj. 2307)
(AD-A094432; AFOSR-81-0017TR) Avail: NTIS HC A07/MF A01 CSCL 20/11

A theoretical investigation was made for the determination of the three dimensional stress field of a cracked plate, of an arbitrary thickness, 2h, and subjected to a uniform external load of mode I. The displacement and stress fields are expressed in terms of the displacement V projected onto the plane containing the crack. In addition, the question of uniqueness is examined for a whole class of these three dimensional crack problems. It is found that solutions to such problems in elastostatics are unique, provided they satisfy the condition of local finite energy everywhere. Finally, it is shown that the solution is complete and it appears that at the corner, where the crack front meets the free surface of the plate, the solution is not separable either in spherical or cylindrical coordinates. GRA

N81-18416# Army Natick Labs., Mass.
DEVELOPMENT OF AN APPARATUS FOR BIAXIAL AND SHEAR STRESS-STRAIN TESTING OF FABRICS AND FILMS Final Report, Oct. 1975 - Sep. 1979
Constantin J. Monego and Malcolm N. Pilsworth, Jr. Oct. 1980 46 p refs
(AD-A094270; NATICK/TR-80/028) Avail: NTIS HC A03/MF A01 CSCL 11/5

This report describes the design, construction and evaluation of an apparatus for the measurement of the behavior of fabrics under biaxial tensile and shear forces. The instrument was evaluated by the testing of fabrics ranging in weight from 34 g/m to 486 g/m, corresponding to material applications ranging from lightweight parachute fabrics to heavyweight ballistic fabrics. The testwork demonstrates that the instrument, within the limitations of the testing techniques developed to date, can be used to provide the information necessary for the design of structural fabrics, the drafting of improved procurement specifications for fabrics and qualification of new fabrics for military applications. Technical problems and limitations of the instrument and of the testing techniques which require further study are discussed. GRA

N81-18417# Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
A STRESS ANALYSIS OF CIRCULAR CYLINDRICAL SHELL INTERSECTIONS, INCLUDING THE INFLUENCES OF REINFORCEMENT, CYCLIC PLASTICITY AND FATIGUE Ph.D. Thesis
Dilip P. Rajkotis and William C. Schnobrich Dec. 1980 239 p refs
(Contract N00014-75-C-0164; NR Proj. 064-183)
(AD-A094153; SRS-483; UILU-ENG-80-2023) Avail: NTIS HC A11/MF A01 CSCL 20/11

The intersection of cylinders is an unavoidable element in many engineering installations such as nozzle to cylinder connections in nuclear reactors or pressure vessels, pipe intersections in offshore platforms, etc. The region of intersection presents a sharp geometric discontinuity in the structure which produces a stress field with very high stress concentration. A unified in depth study of the behavior of cylinder intersections is presented in this document. This study consists of numerical evaluations of the stress fields in the vicinity of the cylindrical shell intersections. Included in the study are variations of reinforcement configurations around the curve of intersection, variations of nozzle to cylinder diameter ratios, variations of angles of intersection, and cyclic plasticity. The finite element method is employed for this stress analysis. An algorithm is developed

for an automated mesh generation covering the region of the cylinder intersection. A kinematic strain hardening material model is formulated for application to cases with cyclic plasticity. The results of the nonlinear analysis are incorporated with existing numerical techniques to predict the fatigue life of the components involved. GRA

N81-18418# Stanford Univ., Calif.
THE BASIS FOR AN ELASTIC-PLASTIC CODE
E. H. Lee May 1976 23 p refs
(Contract N00014-75-C-0923; NR Proj. 031-768)
(AD-A094028) Avail: NTIS HC A02/MF A01 CSCL 20/11

A complete stress analysis of a metal forming process is necessary in order to assess the onset of metal forming defects such as the initiation of internal or surface cracks or the generation of residual stresses and this demands elastic-plastic analysis. This report comprises comments on the plasticity theory formulation needed for a finite element computer code designed for the analysis of metal forming processes. J. R. Rice has pointed out the importance of convection and rotation terms in the definition of stress rate for inclusion in elastic-plastic constitutive relations and that the development of uniqueness and stability analysis by R. Hill provides a convenient vehicle for including these effects. The development of these concepts is described and how they generate a convenient variational principle to form the basis of an elastic-plastic code to analyze metal forming. GRA

N81-18419# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INVESTIGATION OF EMAT BASE SYSTEM FOR THE DETECTION OF BOLT HOLE TYPE CRACKS. PART 1: DETECTION OF CRACKS IN THE INACCESSIBLE LOWER HALF WING LAP JOINTS USING EMATS Interim Report, 1 Apr. - 31 Aug. 1978
C. V. Vasile, R. H. Houston, and R. B. Thompson Jul. 1980 66 p refs
(Contract F33615-74-C-5180; DARPA Order 2828; AF Proj. 7351)
(AD-A094349; SC595.44C5A; AFWAL-TR-80-4081-Pt-1) Avail: NTIS HC A04/MF A01 CSCL 01/3

The detection of saw slots in an aircraft wing lap joint is demonstrated with EMATS (Electromagnetic acoustic transducers) utilizing 250 KHz horizontal shear acoustic waves reflected from the fastener area. A real time Fourier transform signal processor was developed and used to gather experimental data and generate plots of power vs. frequency as well as the complex transform. A simple ultrasonics model is described which is capable of explaining many of the features of the experimental data. GRA

N81-18420# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INVESTIGATION OF EMAT BASE SYSTEM FOR THE DETECTION OF BOLT HOLE TYPE CRACKS. PART 2: RELIABILITY EVALUATION AND SYSTEM DEFINITION FOR DETECTION OF CRACKS UNDER FASTENERS BY EMATS Interim Report, 12 Apr. - 15 Sep. 1979
J. F. Martin, P. J. Hodgetts, and R. B. Thompson Jul. 1980 105 p refs
(Contract F33615-74-C-5180; DARPA Order 2828; AF Proj. 7351)
(AD-A094350; SC595.65IR; AFWAL-TR-80-4081-Pt-2) Avail: NTIS HC A06/MF A01 CSCL 01/3

The detection of laboratory grown fatigue cracks in aircraft wing lap joint fastener holes is demonstrated with EMATs (electromagnetic acoustic transducers). Operating at a 200 kHz central frequency, the EMATs employ acoustic waves in reflection and transmission to measure the presence of both fatigue cracks and loose fasteners. A minicomputer-based data acquisition and analysis system acquires, gates, apodizes and Fourier transforms each received time waveform. The resulting spectra are then compared to the spectra of uncracked holes with tight fasteners to determine the presence of a crack or loose fastener. A method for distinguishing the difference between a crack and a loose fastener is demonstrated. A suggested design for a fieldable instrument capable of the same abilities is presented. GRA

N81-18421# Bettis Atomic Power Lab., West Mifflin, Pa.
THERMOMECHANICAL THEORY OF MATERIALS UNDERGOING LARGE ELASTIC AND VISCOPLASTIC DEFORMATION (AWBA DEVELOPMENT PROGRAM)
S. E. Martin and J. B. Newman Nov. 1980 49 p refs
(Contract DE-AC11-76PN-00014)
(WAPD-TM-1472) Avail: NTIS HC A03/MF A01

A thermomechanical theory of large deformation elastic inelastic material behavior is developed which is based on a multiplicative decomposition of the strain. Very general assumptions are made for the elastic and inelastic constitutive relations and effects such as thermally activated creep, fast neutron flux induced creep and growth, annealing, and strain recovery are compatible with the theory. Reduced forms of the constitutive equations are derived by use of the second law of thermodynamics in the form of the Clausius-Duhem inequality. Observer invariant equations are derived by use of an invariance principle which is a generalization of the principle of material frame indifference. DOE

N81-18422# Sandia Corp., Albuquerque, N. Mex.
DYNAMIC RELAXATION APPLIED TO THE QUASI-STATIC, LARGE DEFORMATION, INELASTIC RESPONSE OF AXISYMMETRIC SOLIDS
Samuel S. Key, C. M. Stone, and R. D. Kreig 1980 36 p refs Presented at U.S./Europe Workshop on Nonlinear Finite Element Analysis in Structural Mech., Ruhr, West Germany, 28 Jul. 1980
(Contract DE-AC-04-76DP-00789)
(SAND-80-1605C; CONF-800781-1) Avail: NTIS HC A03/MF A01

The use of dynamic relaxation as a solution strategy for the quasi-static, large deformation, inelastic response of solids is examined. The underlying mechanics, the constitutive theories of interest, the incremental form of the equations, the spatial discretization, and the implementation of dynamic relaxation for path and/or time dependent material response are discussed. The mechanics are carried out in the current configuration of the body described by a fixed spatial coordinate system and using the Cauchy stress. Finite strain constitutive theories for elastic, elastoplastic, and creep behavior are introduced. An incremented form of the problem allowing a sequence of equilibrium solutions to be found is presented. A constant bulk strain, bilinear displacement isoparametric quadrilateral finite element is employed for the spatial discretization. The solution strategy used to generate the sequence of equilibrium solutions is dynamic relaxation which in the form adopted is based on explicit central difference pseudo-time integration and artificial damping. DOE

N81-18423# Sandia Labs., Albuquerque, N. Mex.
NUMERICAL IMPLEMENTATION OF INELASTIC TIME DEPENDENT AND TIME INDEPENDENT, FINITE STRAIN CONSTITUTIVE EQUATIONS IN SOLIDS
S. W. Key and R. D. Krieg 1980 16 p refs Presented at 2d Intern. Congr. on Numerous Methods for Engr., Ithaca, N.Y., 11 Nov. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1966C; CONF-801159-1; CONF-801207-2; CONF-801224-1) Avail: NTIS HC A02/MF A01

A number of complex issues are addressed which will allow the incorporation of finite strain, inelastic material behavior into the piecewise numerical construction of solutions in solid mechanics. An elementary time independent plasticity model, an elementary time dependent creep model, and a viscoelastic model are introduced as examples of constitutive equations which are all suitable for problems involving large deformations and finite strains. The plasticity and creep models are in rate form and use the symmetric part of the velocity gradient or the stretching to compute the corotational time derivative of the Cauchy stress. The viscoelastic model computes the current value of the Cauchy stress from a hereditary integral of a materially invariant form of the stretching history. The current configuration is selected for evaluation of equilibrium as opposed to either the reference configuration or the last established equilibrium configuration. The process of strain incrementation is examined and the stretching evaluated at the midinterval multiplied by the time

step is identified as the appropriate finite strain increment to use with the selected form of the constitutive equations. DOE

N81-18424 Mississippi State Univ., State College.
BARREL SHELLS HAVING BOUNDARIES CONSISTENT WITH MEMBRANE SHELL THEORY Ph.D. Thesis
Samuel Earl French 1980 105 p
Avail: Univ. Microfilms Order No. 8104483

An analysis of barrel shells is developed within the limits of the Finsterwalder approach to barrel shells. The analysis includes the shears and moments which occur as a result of surface loadings. The use of a set of auxiliary variables is combined with a simple observation in deformations to form the basis for the analysis. The final solution for longitudinal stress is given by the initial membrane solution. The longitudinal moments which occur in a long barrel shell are induced primarily by the meridional moments through the effects of Poisson's ration. An analysis is developed for complete cylindrical shells that are loaded as barrel shells. A large group of problems in cylindrical shells fall in a special case of the general theory of bending and their solution is a simple straightforward closed form solution, which includes flexure and shear. Dissert. Abstr.

N81-18425 Stanford Univ., Calif.
EVALUATION OF THEORIES ON MULTIAXIAL FATIGUE WITH DISCRIMINATING SPECIMENS Ph.D. Thesis
Soon-Bok Lee 1980 174 p
Avail: Univ. Microfilms Order No. 8103532

Comparisons of several theories on multiaxial fatigue, a design formula for out of phase torsion and bending, and data on the fatigue behavior of two pressure vessel steels under out of phase bending and torsion are presented. Discriminating specimens were used to compare the predictive powers of three formulas. Three sets of tests were performed. Two of them were performed under synchronous practically sinusoidal, fully reversed, loading with 90 degree phase lag between torsion and bending. The first set is the exploratory test with stepwise loading. The second set is the main tests. Results for the main tests were presented in two groups: one is with annealed stainless steel type 304, the other A533B steel. Failures occurred at the location which experienced equivalent stress ranges lower than other locations if equivalence is calculated by conventional theories. Failure was defined as a 10 percent loss in the specimen stiffness, which corresponds to visible cracking. Dissert. Abstr.

N81-18426 Arizona Univ., Tucson.
GEOMETRICALLY NONLINEAR FINITE ELEMENT ANALYSIS OF CIRCULAR AND ARBITRARY ARCHES Ph.D. Thesis
Philip Ray Calhoun 1980 159 p
Avail: Univ. Microfilms Order No. 8104290

A curved nonlinear finite element is developed to observe the behavior of slender arches which undergo large deformations. The derivation of the strain equation is based upon the assumption that cross sections of the undeformed state remain undeformed and plane, but not necessarily normal to the centroidal axis during deformation. It is also assumed that the strain will be small and the rotations will be finite. The inplane bending and the buckling modes for arches with fixed end and hinged end supports are analyzed. Deep circular arches and deep arches with arbitrary geometry of the centroidal axis are studied. Vertical concentrated loads, uniformly distributed loads, a combination of concentrated and distributed loads, and nonsymmetrical loads are considered. The governing differential equations are differentiated with respect to time to give a system of rate equations. Using these equations, the original nonlinear differential equations are solved using the Runge-Kutta scheme with Simpson's coefficients. If the solution drifts, a Newton-Raphson iteration scheme is used to return the solution to the equilibrium path. Dissert. Abstr.

N81-18427 Massachusetts Univ., Amherst.
HETERODYNE DETECTORS FOR 10 MICRON ASTRONOMY APPLICATIONS Ph.D. Thesis
James Francis Shanley 1980 161 p
Avail: Univ. Microfilms Order No. 8101394

The use of heterodyne detection techniques is demonstrated in many regions of the electromagnetic spectrum including the radiowave, microwave, infrared, and optical. Heterodyne detection offers the advantages of high sensitivity, frequency selectivity, and strong directivity. Heterodyne radiometers using lasers as local oscillators are useful for detecting weak radiation signals which have narrow spectral widths. This detection technique is very useful for detecting thermal and non-thermal radiation from planetary atmospheres, including the Earth, and from gaseous clouds surrounding infrared radiating stars. The detectors are capable of attaining shot-noise-limited behavior and high sensitivities when operated in the heterodyne mode. An analytical model that is capable of predicting the performance of the heterodyne detectors is described. Dissert. Abstr.

N81-18428 Rensselaer Polytechnic Inst., Troy, N. Y.
THERMAL BUCKLING OF INITIALLY STRESSED THICK PLATES Ph.D. Thesis
Lien-Wen Chen 1980 87 p
Avail: Univ. Microfilms Order No. 8103755

Equations of motion for a transversely isotropic thick plate with thermal effects in a general state of nonuniform initial stress where the effects of transverse shear and rotary inertia are included are derived by two methods. The first method is to perturb the nonlinear equations of elasticity by an incremental deformation. The resulting equations are linearized and integrated through the thickness of the plate to obtain the thermal elastic plate equations. The second method is to derive the governing equations of a thermal elastic thick plate directly from the variational Hamilton's principle. A reduced set of equations for a thick plate with thermal effects is also given. Finally, the thermal buckling problems are solved for simply supported rectangular plates in a state of uniform compressive (or tensile) initial stress plus uniform initial bending stress combined with uniform thermal compressive stress plus uniform thermal bending stress. The effects of various parameter on thermal buckling load are studied. Dissert. Abstr.

N81-18997*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
WIND LOADS FOR BAR-TRUSS STRUCTURES
M. S. Katow *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 149-153 refs (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N81-18429 Colorado Univ. at Boulder.
AN ISLAND IN GEOGRAPHIC TRANSITION: A STUDY OF THE CHANGING LAND USE PATTERNS OF PADRE ISLAND, TEXAS Ph.D. Thesis
Roberto Garza 1980 223 p
Avail: Univ. Microfilms Order No. 8103096

Padre Island, by virtue of its location and natural resources, possesses the potential of becoming an intensively devloped recreation area in south Texas. The primary objectives are five-fold: to reconstruct the land use patterns through time; to analyze the effects that different types of land use have had and may be having on the various geomorphic subdivisions of Padre Island; to determine what effects the storms and hurricanes have had and may have on the new developments; to make projections of future land use patterns in the undeveloped portions of Padre

Island; and to make recommendations for better land use practices. Recommendations for better land use practices on the island are made. Dissert. Abstr.

N81-18430 Maryland Univ., College Park.
INVESTIGATIONS INTO THE DYNAMICS OF WATER MOVEMENT ON A LOW RELIEF LANDSCAPE ON THE EASTERN SHORE OF MARYLAND Ph.D. Thesis
Michael Scott Christy 1980 169 p
Avail: Univ. Microfilms Order No. 8103869

A computerized model, with an adjustment to include interception, was used to determine a workable water budget. Boundaries of surface and subsurface watershed divides were determined and compared. Data were incorporated into the SYMAP computer package to prepare a collection of contour maps. Analysis of the maps shows significant subsurface watershed divide shifts under certain circumstances. In normal and drier than normal years, divide shifts were noted while in a wet year they were not. Since there is so little relief, contrasting vegetation covers are assumed to be a prominent factor in the control of this phenomenon. One result from these divide shifts was a ground water gradient reversal over more than half of the watershed. Consequently, the watertable was no longer subparallel to the land surface in this area. This departure from the conventional relationship between topography and the underlying watertable is again thought to be restricted to relatively flat landscapes. Dissert. Abstr.

N81-18431 Denver Univ., Colo.
AN EVALUATION OF THE THIESSEN POLYGON METHOD FOR ASSESSING AREAL PRECIPITATION DEPTHS: A SIMULATED APPROACH Ph.D. Thesis
Arthur Viterito 1980 161 p
Avail: Univ. Microfilms Order No. 8101704

The accuracy of the Thiessen method was compared with that of the arithmetic mean (considered to possess less accuracy) and the isohyetal method (considered to possess greater accuracy) for a wide range of precipitation and gage network parameters. A precipitation simulation procedure was employed to allow control for a number of factors which affect accuracy. These include precipitation pattern, areal variability, gage coverage and gage pattern. Elliptical and multicellular rainfall patterns were simulated with areal variability ranging from 1 percent to 140 percent. The attendant gage networks were of two types: randomly (unevenly) and evenly arranged. The findings show that the Thiessen method is the most accurate of the three methods for elliptical precipitation patterns with randomly arranged gage networks. A similar result is obtained for elliptical patterns with evenly arranged gage networks when the gage coverage is good for multicellular precipitation patterns, all methods proved to be of similar accuracy for both types of gage network arrangement. Dissert. Abstr.

N81-18432 Purdue Univ., Lafayette, Ind.
STOCHASTIC ANALYSIS AND MODELING OF HYDROLOGIC AND CLIMATOLOGIC TIME SERIES Ph.D. Thesis
G. Padmanabhan 1980 386 p
Avail: Univ. Microfilms Order No. 8102694

Four methods--maximum entropy, maximum likelihood, non-integer and G-spectral methods are investigated and compared with conventional method by using hydrologic climatologic data. Maximum entropy (ME) method easily emerges to be superior to other methods and hence is recommended for use in hydrology and climatology. Some of the stochastic model identificaton tools which can be easily computed as a part of general computational scheme of ME method make it useful in stochastic model construction. Maximum entropy method makes it possible to integrate spectral analysis and model construction. Other features such as its close relationship with maximum likelihood method and its adaptability for cross spectral estimation are demonstrated as additional advantages of ME method. One of the problems associated with ME method is the determinaton of the correct order of the filter to be used in the method. A criterion for this purpose is investigated. Problems concerning causality are also studied. Dissert. Abstr.

N81-18433 Purdue Univ., Lafayette, Ind.
INVESTIGATION AND DEVELOPMENT OF URBAN HYDROLOGIC MODELS Ph.D. Thesis
Ji Han 1980 308 p
Avail: Univ. Microfilms Order No. 8102662

The regeneration and prediction performances of three urban runoff models in which optimal parameter estimates are used were compared with the performance of models in which the parameter values are arbitrarily specified. The complexity of model structure does not guarantee better performance. Two sets of the objective functions were tested by using the data from the Upper Ross-Ade and Oakdale Avenue watersheds. A simple, readily usable, and theoretical sound model which includes ILLUDAS and a dynamic programming subroutine was developed and tested by using data from Upper Ross-Ade and Bar Barry Heights watersheds. The model was used to investigate the variation of system costs with the variation in design parameters and to optimally size the detention storage volume for the least cost of the system. Dissert. Abstr.

N81-18434 Purdue Univ., Lafayette, Ind.
DIGITAL IMAGE SIMULATION FOR PHOTOGRAMMETRIC APPLICATIONS Ph.D. Thesis
John-Edward Unruh 1980 276 p
Avail: Univ. Microfilms Order No. 8102716

The feasibility of using computer generated image displays which simulate aerial photographs in lieu of actual photography for photogrammetric experimentation is described. Factors affecting photograph simulation, the compilation of ground descriptions for photograph simulation and, a computer program developed for this purpose are discussed. Sample simulated photographs are presented. Monoscopic and stereoscopic pointing experiments using both simulated photographs and digitized photographs are also described. The capability to program a wide range of image characteristics into the displays was demonstrated. Pointing experiments showed that in terms of measurement accuracy and precision, observers respond similarly to both real and simulated photography. Photograph-like displays were demonstrated as a tool for viewing and editing digital cartographic data. Dissert. Abstr.

N81-18435 Washington Univ., St. Louis, Mo.
A NETWORK DATA MODEL FOR CARTOGRAPHIC FEATURES Ph.D. Thesis
Paula Jeane Hagan 1980 191 p
Avail: Univ. Microfilms Order No. 8103710

A data structure using CODASYL owner member constructs to model point, lineal, and areal cartographic features was developed. The structure has the advantage of allowing interfeature relationships to be computed at query time and network paths to be computed using direct links instead of searches. It is shown that the performance of the model is driven by the number of segments in a feature, a consequence of the segment representation technique. Factors to evaluate any logical design and the inherent structure of cartographic data are discussed along with the interrelationship of the data structure, query language compiler, knowledge model, and inferencing techniques in a comprehensive data base system applicable to any data base processing environment. Dissert. Abstr.

N81-18436# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
THE COMPUTER AS AN INSTRUMENT IN PHYSICAL GEOGRAPHY [DE COMPUTER IN DE FYSISCH GEOGRAFIE]
1979 126 p refs In DUTCH Lectures held at Amsterdam Univ., 14 Apr. 1978
(Rept-6) Avail: NTIS HC A07/MF A01

The utilization of computers in an academic environment and as an aid in scientific research is examined. The following topics are discussed: the computer as an instrument in physical geography; computer systems and simulation models; digital image processing of satellite photographs; computer literature retrieval in geographical sciences; automatic data processing; programs for automatic data processing; and computer assisted statistical operations. For individual titles, see N81-18437 through N81-18443.

N81-18437# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.

THE COMPUTER AS AN INSTRUMENT IN PHYSICAL GEOGRAPHY [DE COMPUTER ALS HULPMIDDEL IN DE FYSISCHE GEOGRAFIE]
Rob vanderTuin *In its* The Computer as an Instr. in Phys. Geography 1979 p 1-11 refs In DUTCH (For primary document see N81-18436 09-43)
Avail: NTIS HC A07/MF A01

The development of an assembler language and its advantages and disadvantages are discussed. The Dutch computer system developed by SARA (Foundation Academic Computer Center, Amsterdam), its batch terminals and its interactive terminals are examined. SARA's benefits to program writing and its economic feasibility in the application to science are enumerated. Transl. by E.A.K.

N81-18438# Amsterdam Univ. (Netherlands). Landbouwhogeschool Wageningen.
COMPUTER SYSTEMS AND SIMULATION MODELS [COMPUTER SYSTEMEN EN SIMULATIE MODELLEN]
Johan A. A. Berkhout *In its* The Computer as an Instr. in Phys. Geography 1979 p 13-33 refs In DUTCH (For primary document see N81-18436 09-43)
Avail: NTIS HC A07/MF A01

Various computer systems, their application to science (data storage and calculations) and information retrieval are examined. The simulation models and their application to physical geography are discussed in particular. Three different phases in the construction of simulation models are distinguished: (1) defining the systems to be researched; (2) construction of the model; and (3) quality control and application of the model. It is concluded that the state of a system can be expressed quantitatively at any time and changes in the system can be reflected with examples of mathematical equations. Transl. by E.A.K.

N81-18439# Amsterdam Univ. (Netherlands).
DIGITAL IMAGE PROCESSING OF SATELLITE PHOTOGRAPHS [DIGITALE BEELDVERWERKING VAN SATELLIET OPNAMEN]
Nico H. W. Donker *In its* The Computer as an Instr. in Phys. Geography 1979 p 35-61 refs In DUTCH (For primary document see N81-18436 09-43)
Avail: NTIS HC A07/MF A01

The use of satellites in obtaining information about the Earth and the recording of digital images is discussed. Employment of satellites, especially for information to underdeveloped countries in their exploration of soil and weather patterns and predictions, is examined. Too far advanced techniques for third world countries are considered disadvantageous. The following criteria are considered in the application of satellite information: (1) greater reliability (no continuous adjustment of equipment to process data); (2) high recording frequency (no cloud interference); (3) speed (soil control recordings have to be available immediately). It is concluded that there is still a shortage of soil scientists who are able to combine their discipline with computer technology. Transl. by E.A.K.

N81-18440# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
COMPUTER-ASSISTED LITERATURE RETRIEVAL, IN PARTICULAR IN THE GEOGRAPHICAL SCIENCES [LITERATUR ZOEKEN MET DE COMPUTER, IN HET BIJZONDER BIJ DE GEOGRAFISCHE WETENSCHAPPEN]
Piet Tieleman *In its* The Computer as an Instr. in Phys. Geography 1979 p 63-89 refs In DUTCH (For primary document see N81-18436 09-43)
Avail: NTIS HC A07/MF A01

The automatic processing of documents in scientific and school libraries is discussed. A variety of information retrieval systems, on-line literature information, and data transmission are examined. The benefits of catalog automatization in scientific libraries and the possibilities for school library systems as well as international reference and communication systems are enumerated. Expectations for the future in the development of catalogs via computerized indexes and off-line retrieval into conversational on-line systems are outlined. Transl. by E.A.K.

N81-18441# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
AUTOMATIC PROCESSING OF MEASURING DATA [DE GEAUTOMATISEERDE VERWERKING VAN MEETGEGEVENS]
Ed deWater *In its* The Computer as an Instr. in Phys. Geography 1979 p 91-102 In DUTCH (For primary document see N81-18436 09-43)
Avail: NTIS HC A07/MF A01

The historical development of automatic processing systems is examined. The development took place in three phases: phase A., originally measurements were determined by reading and recording of quantities (disadvantage, only small quantity of data can be processed at one time); phase B., registering measurement instruments, which provide immediate information; and phase C., registering on a medium which enables assimilation by computer, (disadvantage information is not immediately available). The impact on the development of electronic technology on computer technology which consequently brought forth the microprocessors is also discussed. Transl. by E.A.K.

N81-18442# Amsterdam Univ. (Netherlands). Fysisch Geografisch en Bodemkundig Lab.
A PROGRAM FOR THE AUTOMATIC PROCESSING OF MEASURING DATA [EEN PROGRAMMA VOOR DE AUTOMATISCHE VERWERKING VAN MEETGEGEVENS]
Rob vanderTuin *In its* The Computer as an Instr. in Phys. Geography 1979 p 103-114 In DUTCH (For primary document see N81-18436 09-43)
Avail: NTIS HC A07/MF A01

The development of a microdatalogger which records measurements on a magnetic cassette while employing very little electrical current is described. The apparatus is designed to record hydrologic field information (e.g. rain intensity, precipitation quantity, water level, water temperature, soil temperature, pH, conductivity, and turbidity) and the time between two measurements. Incoming data are registered according to ECMA-34 norms. It was found that the program is very flexible which enables it to examine a great number of measuring data on relevant aspects within a very short period of time. Transl. by E.A.K.

N81-18443# Amsterdam Univ. (Netherlands).
COMPUTER-ASSISTED STATISTICAL OPERATIONS, IN PARTICULAR WITH THE SOFTWARE PACKAGE SPSS [STATISTISCHE BEWERKINGEN MET DE COMPUTER, IN HET BIJZONDER MET HET PROGRAMMAPAKKET SPSS]
Harry vanZon *In its* The Computer as an Instr. in Phys. Geography 1979 p 115-123 refs In DUTCH (For primary document see N81-18436 09-43)
Avail: NTIS HC A07/MF A01

The SPSS program library and its utilization is described. The SPSS is a compact and flexible system which enables the operator to execute many different tasks in a simple and easy manner. The SPSS provides data management, statistic processing, and statistic keys. The SPSS offers a great variety in the application of parametric as well as nonparametric statistics, while it is expanded continuously. Transl. by E.A.K.

N81-18444# European Space Agency, Paris (France).
INSTRUMENTATION FOR PREPROCESSING OF SAR DATA TO IMAGE FORM
Norman Longdon, ed. Jul. 1980 106 p refs Proceedings of 2nd SEASAT-SAR Working Group Meeting, Frascati, Italy, 13-14 Dec. 1979 Prepared in cooperation with Intern. Soc. of Photogrammetry
(ESA-SP-1031) Avail: NTIS HC A06/MF A01

The working group reviewed existing digital and optical SEASAT synthetic aperture radar processors and the instrumentation which is needed for future systems was discussed. Analog and digital devices, image storage and archiving hardware and bit organized parallel processors were considered. For individual titles, see N81-18445 through N81-18457.

N81-18445# European Space Agency, Paris (France).
STATE-OF-THE-ART OF THE SEASAT DIGITAL SAR PROCESSORS
J. P. Guignard *In its* Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 3-5 refs (For primary document see N81-18444 09-43)
Avail: NTIS HC A06/MF A01

The hardware configurations used in six laboratories for processing data from SEASAT synthetic aperture radar (SAR) are listed. Included is all equipment needed to interface the high density digital recorder and to generate computer compatible tapes and printed data. Although the processing algorithms used differed, there is much commonality of hardware. All systems are based on 16 or 32 bit minicomputers, array processors and disk storage. Author (ESA)

N81-18446*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

A SOFTWARE-BASED SYSTEM WHICH PRODUCES SEASAT SAR IMAGERY

Chialin Wu *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 7-13 refs (For primary document see N81-18444 09-43)

(Contract NAS7-100)

Avail: NTIS HC A06/MF A01 CSCL 09B

A digital processing algorithm and its associated system design for producing images from SEASAT synthetic aperture radar (SAR) data is described. The proposed system uses the fast Fourier transform approach to perform the two dimensional correlation process. The range migration problem can be alleviated by approximating the locus of echoes from a point target by several linear segments. Data corresponding to each segment are correlated separately and the results are coherently summed to produce full resolution images. This processing approach exhibits high computation efficiency and simple processing control functions. It is particularly attractive for software implementation based on general purpose computers. Results of this implementation and examples of digitally correlated SEASAT SAR imagery are discussed. Author (ESA)

N81-18447# MacDonald, Dettwiler and Associates Ltd., Richmond (British Columbia).

A REAL-TIME AIRBORNE SYNTHETIC APERTURE RADAR PROCESSOR

John R. Bennett, Pietro Widmer, and Ian G. Cumming *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 15-23 refs (For primary document see N81-18444 09-43)

Avail: NTIS HC A06/MF A01

A one-look digital processor for a dual polarization X-L band synthetic aperture radar was built and installed on a Convair aircraft. The airborne processor performs both pulse compression in range and synthetic aperture formation in azimuth. The time domain convolution algorithm used is described and a block diagram of the hardware given with some performance data. A laser beam recorder using heat developed dry silver paper is used to provide real time image output. Author (ESA)

N81-18448# European Space Research and Technology Center, Noordwijk (Netherlands).

INSTRUMENTATION FOR HIGH THROUGHPUT SYNTHETIC APERTURE RADAR SIGNAL PROCESSORS

J. C. Degavre *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 25-29 refs (For primary document see N81-18444 09-43)

Avail: NTIS HC A06/MF A01

The characteristics of the satellite synthetic aperture radars envisaged by ESA for a European Remote Sensing Program and possible radar signal processing system are given. Memory requirement and arithmetic load are estimated, assessing the throughput capacity of special purpose hardware and computer based ground processors. Results show that real time processing of data from proposed remote sensing satellites is feasible, but must be implemented on special purpose hardware. An image from a typical satellite (100 km x 100 km) can be obtained in 30 min. Author (ESA)

N81-18449# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

BREADBOARD ACTIVITIES ON SYNTHETIC APERTURE CORRELATORS AND SYNTHETIC APERTURE RADAR SIMULATOR

R. Schotter *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 31-33 (For primary document see N81-18444 09-43)

Avail: NTIS HC A06/MF A01

A breadboard model of an analog charge coupled device 64 word correlator was tested for synthetic aperture radar (SAR) azimuth processing. The 32 word analog correlator R 5403 is used, two being cascaded indirectly to form one 64 word correlator. For analysis and tests, two SAR simulators were built to provide the azimuth correlator with specific radar signals. Measurements are discussed and a method shown for performing a real time subaperture correlation at a swath width of 100 km. A comparison between the results of cross correlation realized by the 64 word complex analog correlation and the corresponding digital correlation is given. Author (ESA)

N81-18450# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

THE MICROWAVE REMOTE SENSING EXPERIMENT

B. Fritsch and G. Bommas *In* ESA Instrumentation for Preprocessing or SAR Data to Image Form Jan. 1980 p 35-37 (For primary document see N81-18444 09-43)

Avail: NTIS HC A06/MF A01

An experimental instrument which measures the directional wave height spectrum of the sea surface by the two frequency scatterometer method and generates high resolution radar images of land surfaces by application of the synthetic aperture principle is described. The experiment is in the integration phase and is a demonstration of European sensor technology and offers to the experimenters a possbility of gaining experience with this sensor. Parameters for the synthetic aperture mode and for azimuth processing are listed. Facilities for data transmission and ground processing are mentioned. Author (ESA)

N81-18451# Canada Centre for Remote Sensing, Ottawa (Ontario).

A QUICK-LOOK SEASAT SAR DIGITAL PROCESSOR

E. Shaw *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 39-41 refs (For primary document see N81-18444 09-43)

Avail: NTIS HC A06/MF A01

The problems of range cell migration and the large amount of computation time required for SEASAT data processing are discussed. A skew time domain approach is described, which reduces the offset Doppler range migration to zero Doppler migration. The resolution is reduced to 100 m, but with a factor 16 reduction in data processing workload. The processor is implemented on a DEC 10/90 computer. A 17 km by 20 km seven look image requires two hours and 20 minutes.

Author (ESA)

N81-18452# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.

OPTICAL PROCESSING OF SEASAT-SAR DATA

I. Cindrich, C. Dwyer, A. Klooster, and J. Marks *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 43-74 refs (For primary document see N81-18444 09-43)

Avail: NTIS HC A06/MF A01

A coherent optical processor system used for processing SEASAT-A synthetic aperture radar data is described and examples of resultant radar imagery are presented. The processor provides simultaneous two dimensional radar data processing to generate high resolution radar imagery at a high throughput capacity. The principles of radar data characteristics are reviewed. The tilted plane optical processor uses a spherical and a cylindrical telescopic lens set operating on the focused light field generated by the zone plate radar data at its input. Phase perturbation caused by azimuth wander, range walk, and range curvature are corrected. Author (ESA)

N81-18453# European Space Agency, Paris (France). Earthnet Programme Office.

SYNTHETIC APERTURE RADAR PROCESSING AND MULTIPLE MISSION REQUIREMENTS

L. Marelli *In its* Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 75-76 (For primary document see N81-18444 09-43)

Avail: NTIS HC A06/MF A01

The processing requirements for the next generation of satellite-borne synthetic aperture radars and optical multispec-

tral sensors are compared briefly with throughput data from SEASAT. Improvements in hardware are mentioned which enable EARTHNET to fulfill its processing requirements, based upon minicomputers with large memories, large disk stores and fast array processors. Data processing workloads associated with input/output, checking, and labelling which were underestimated in the past are indicated. Author (ESA)

N81-18454# Christian Rovsing Ltd., Copenhagen (Denmark).
ARCHIVING AND HANDLING OF IMAGE DATA
Erik H. Nielsen *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 77-82 (For primary document see N81-18444 09-43)
Avail: NTIS HC A06/MF A01

The image data archiving subsystem, which was developed for the METEOSAT ground support system is described. The archive is based on high density digital tape recording technique and the experience from two years of operational use of such a technique is presented. An image file processor was implemented by a special configuration of processing and interface modules interconnected by high speed data buses, which allow the use of several large buffers during input/output operations. By using shared random access memory areas together with special MOVE instructions, data are transferred at high speed between devices. Performance data are given for a number of image handling operations for a 42 M byte multispectral LANDSAT scene. Author (ESA)

N81-18455# GEC-Marconi Electronics Ltd., Chelmsford (England).
IMAGE DATA STORAGE
A. B. E. Ellis *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 83-89 ref (For primary document see N81-18444 09-43)
Avail: NTIS HC A06/MF A01

The current technology for mass storage of image data is reviewed. Magnetic tape systems, including video tape recorders, high density recorders and computer compatible recording are discussed and recording parameters given. Magnetic disks are included and fixed and moving head systems compared. Parameters for video disks are shown, magnetic bubble, semiconductor, and CCD devices are compared. Results show that analog CCDS are limited in comparison to semiconductor memories. Magnetic tape and disk continue to be useful for image storage, with magnetic bubbles eventually replacing disks. Optical disks show promise for archives. Author (ESA)

N81-18456# *Compagnie d'Informatique Militaire, Spatiale et* Aeronautique, Velizy-Villacoublay (France).
SYSTEMS INCLUDING PROPAL II PROCESSOR
J. T. Hollette *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 91-96 refs (For primary document see N81-18444 09-43)
Avail: NTIS HC A06/MF A01

A minicomputer based associative parallel processor was designed for image processing. The parallel processors use serial bit operators performing logical and arithmetic operations on variable length data. The host computer is connected to the processor module by a data channel and a control channel. Each processor contains a 16 bit register which is included also in the stack which serves both as a work register for each elementary processor and as an interchange box for interprocessor communication. Configurations based on a MITRA 125 computer and a SOLAR 16/65 computer are shown. A 100 km x 100 km SAR image can be processed in 8 hours. Author (ESA)

N81-18457# International Computers Ltd., London (England).
BIT-ORGANIZED ARRAY PROCESSORS
Dennis Parkinson *In* ESA Instrumentation for Preprocessing of SAR Data to Image Form Jul. 1980 p 97-99 (For primary document see N81-18444 09-43)
Avail: NTIS HC A06/MF A01

The difference between floating point array processors and cellular array processors CAP are noted and a classification is made of the commercially available processors. Advantages of cellular array processors are listed. They have no built in word length, arithmetic can be tuned to match the precision of the data, and packing and unpacking are unnecessary. Efficient compilers are easier to produce for CAP and certain CAP have switches controlling the activity of individual processing elements permitting easy logical control of selection operations. The processing element of the ICL CAP is described. Author (ESA)

N81-18458# European Space Agency, Paris (France). EARTHNET Programme Office.
SEASAT-SAR PROCESSOR
1981 139 p refs Proceedings of ESRIN Workshop, Frascati, Italy 10 - 14 Dec. 1979
(ESA-SP-154; ISSN-0379-6566) Avail: NTIS HC A07/MF A01

Topics discussed at the workshop include SEASAT imagery of land, sea, and ice surfaces, processing of partially coherent phenomena, and image processing software and hardware for synthetic aperture radar data comparison of SEASAT and LANDSAT images. The status of various microwave remote sensing projects is assessed. For individual titles, see N81-18459 through N81-18475.

N81-18459# Bern Univ. (Switzerland). Inst. of Applied Physics.
EXPERIENCE WITH SEASAT
E. Schanda *In* ESA SEASAT-SAR Processor 1980 p 3-8 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Resolution problems experienced in using optically processed synthetic aperture radar (SAR) images from SEASAT for soil moisture studies are briefly listed. Recommendations are made for improvements in SAR for land applications. Calibration is needed in terms of backscattered signal in steps of less than 2 db for relative and less than 10 db for absolute calibration. Storage of the full dynamic range of intensities is needed. Processing requirements call for digital processing and maps of numerical valves of calibrated intensity. An alert system (6 to 24 hr Telex warning) is needed to warn of unscheduled use of the satellite sensors. Coordination of underflights by comparable sensors is recommended. Author (ESA)

N81-18460# Hunting Surveys Ltd., Boreham Wood (England).
PRELIMINARY RESULTS OF AN EVALUATION OF THE LAND USE AND GEOLOGIC DATA CONTENT OF SEASAT IMAGERY
M. McDonough and G. Deane *In* ESA SEASAT-SAR Processor 1980 p 9-18 Sponsored by RAE, Farnborough, England (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Both optically and digitally correlated SEASAT SAR imagery were examined to test their applicability to geologic and land use mapping. In Northern Scotland, East Yorkshire and Southwest England, although surface cover inhibits direct expression of lithologies and many important units are not separable, important structures and other major rock units can be recognized and some information may be regarded as new. Lineaments are numerous. Overlapping imagery from converging orbits provides stereoscopic cover that assists geologic interpretations. In land use evaluations six tone/texture radar mapping units can be identified in East Anglia. After field checking these could be subdivided into land use units. Mature, closed canopy woodland and certain crop groups can be recognized consistently, but some SAR signatures can have several possible interpretations. Hilly terrain modifies these SAR signatures. An IDP 3000 interactive image processor was used to evaluate digitally processed SEASAT SAR and make comparison with Landsat. Author (ESA)

N81-18461# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrictentechnik.
TENTATIVE IMAGE PROCESSING WITH SEASAT-SAR IMAGE CORRELATED ONTO LANDSAT SCENE
K. A. Ulbricht *In* ESA SEASAT-SAR Processor 1980 p 19-23 (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

A SEASAT synthetic aperture radar (SAR) image of August 21, 1978, was geometrically rectified onto a LANDSAT scene of August 28, 1978. Image processing was applied to explain SAR imagery with the help of LANDSAT scenes or vice versa. No ground check was possible. Available cartographic maps proved

to be useless for explanation of phenomena or images. Passpoints for geometrical correlation were taken from border lines of lakes, from mountain tops, or from specific field points. Correlations of LANDSAT and SAR images were used to attempt an explanation of higher resolved SAR imagery grey values and phenomena. False color presentations of several image processing modules show results of unsupervised minimum distance classification as well as supervised maximum likelihood classification. Results can only be tentative because of the lack of adequate ground truth.
Author (ESA)

N81-18462# Hamburg Univ. (West Germany). Inst. fuer Geophysik.
IMAGE CONTRAST ENHANCEMENT BY APPLYING FOCUS ADJUSTMENT IN SYNTHETIC APERTURE RADAR IMAGERY OF MOVING OCEAN WAVES
Werner R. Alpers and Clifford L. Rufenach (NOAA, Boulder, Colo.) *In* ESA SEASAT-SAR Processor 1980 p 25-31 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Image contrast enhancement in synthetic aperture radar (SAR) imagery of ocean waves is shown to be dependent on orbital acceleration effects and not phase velocity of long waves. In order to obtain maximum image contrast, it is necessary to apply a correction to the azimuthal focus setting, which is of the order of R/2V x A sub R where A sub R is the (orbital) acceleration of the water particles in the range direction, R the distance between the platform and the target, and V the platform velocity. The correlation is often of the same order as the phase velocity of long waves. The modulation depth of a SAR image of a monochromatic ocean wave is numerically calculated as a function of the azimuthal focus setting. The calculations clearly show the relevance of focusing for ocean wave imagery of certain SAR and ocean wave parameters. Author (ESA)

N81-18463# Southampton Univ. (England).
SYNTHETIC APERTURE RADAR WAVE IMAGING
D. G. Appelby *In* ESA SEASAT-SAR Processor 1980 p 33-35 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Mechanisms for synthetic aperture radar imaging of ocean waves are reviewed. Theories based on the two scale wave concept are outlined for tilt, roughness and orbital velocity modulation effects. Rayleigh scattering and radar layover are mentioned as being of possible importance in rough sea conditions. Some comments are made on the stationary surface model.
Author (ESA)

N81-18464# Canada Centre for Remote Sensing, Ottawa (Ontario).
SYNTHETIC APERTURE RADAR PROCESSING OF PARTIALLY COHERENT PHENOMENA
R. K. Raney *In* ESA SEASAT-SAR Processor 1980 p 37-52 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Partially coherent synthetic aperture radar (SAR) imaging of a scene that is subjected to random fade is considered. The impulse response, frequency response, and response to extended random fields are formally derived and the problem is addressed of estimating SAR impulse response from measures of spectra corresponding to random distributed scenes. Explicit results are obtained using Gaussian functions to describe the SAR, its coherence, and the scene coherence. Results are presented which converge appropriately on known results for cases treated previously. The results are applied to the problem of SAR imagery of oceanic waves with comments on certain aspects of SAR from the SEASAT-A satellite. Author (ESA)

N81-18465# Institut Franco-Allemand de Recherches, St. Louis (France).
DIRECTIONAL SPECTRA OF WAVES IN THE NORTH SEA. INTERPRETATION OF SEASAT-SAR IMAGES
A. Fontanel and D. deStaerke *In* ESA SEASAT-SAR Processor 1980 p 53-60 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Images and two dimensional spectra from orbit 1149 over the North Sea were analyzed covering an area 800 km by 100 km including the southern part of the Shetland Islands. Approximately 100 optical Fourier Transforms were used to estimate the wavelengths of the waves and their directions of propagation + or - 180 deg. Each spectrum corresponds to a zone measuring about 20 x 20 km. There is considerable variation in the wavelengths present on the sea. Northwest and west of the Shetland Islands waves of more than 300 m wavelength were propagating eastward. The wavelengths decrease progressively toward the southeast, approaching a front running from east to west. To the west of this front the longest wavelengths were no more than 90 m. Author (ESA)

N81-18466# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
COMPARISON OF SEASAT AND LANDSAT DATA OF ICELAND FOR QUALITATIVE GEOLOGICAL APPLICATION
J. Bodechtel, K. Hiller, and U. Muenzer *In* ESA SEASAT-SAR Processor 1980 p 61-67 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

The application of SEASAT synthetic aperture radar (SAR) data for geological application is demonstrated with the example of the young morphologically traced tectonics of Iceland. Advantages and limitation of SAR evaluation including geometric distortion, lay over and structure enhancement are discussed. A comparison of photolineament maps derived from both LANDSAT and SEASAT data is made. Author (ESA)

N81-18467# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
SYNTHETIC APERTURE RADAR IMAGERY OF SEA ICE
Finn Soendergaard *In* ESA SEASAT-SAR Processor 1980 p 69-75 ref (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Weather maps, NOAA 5 satellite photographs and ice maps were compared visually with two SEASAT images taken during revolutions 719 and 762, 16 and 19 Aug., 1978. With moderate to high winds, little difference was found in the level of the backscattered signal from the sea ice and little contrast on the imagery, making discrimination difficult or impossible. The depression angle and frequency of the SEASAT Synthetic Aperture Radar are not well suited for sea ice detection. Author (ESA)

N81-18468# University Coll., Cork (Ireland). Dept. of Civil Engineering.
REQUIREMENTS FOR REMOTE SENSING WAVE DATA NEAR IRELAND
A. W. Lewis *In* ESA SEASAT-SAR Processor 1980 p 77-78 ref (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Offshore drilling operations, feasibility studies for wave power sites, and coastal erosion problems are cited as justifying satellite measurement of wave parameters with Altimeter or synthetic aperture radar. Sea truth sites are identified for calibrating flights i.e., four buoys and one gas production platform.
Author (ESA)

N81-18469# GEC-Marconi Electronics Ltd., Chelmsford (England).
THE INFLUENCE OF RADIOMETRIC RESOLUTION ON SYNTHETIC APERTURE RADAR DESIGN PARAMETERS
S. R. Brooks and P. F. Miller *In* ESA SEASAT-SAR Processor 1980 p 79-85 (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

The dependence of the signal-to-noise ratio on range resolution and the normalized radar scattering cross section is outlined. One interpretation of a proposed measurement of radiometric resolution is discussed. The effect of incoherent integration on radiometric resolution is described for independent observations of the reflectivity of a distributed target. The analysis is extended to include the effect of correlated observations of varying signal-to-noise ratios. Author (ESA)

N81-18470*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT-SAR DATA ANALYSIS IN THE US: AN UPDATE
James A. Dunne *In* ESA SEASAT-SAR Processor 1980 p 87-89 ref (For primary document see N81-18458 09-43)

(Contract NAS7-100)
Avail: NTIS HC A07/MF A01 CSCL 05B

A graph is shown which compares SEASAT synthetic aperture radar (SAR) wave length measurements and Krasman's shallow water dispersion relationship for a swell system of deep water length 210 m and period 11.7 sec. The data were taken during the Duck experiment. The status of the production of optically correlated SAR data is given along with a tabulation of both digitally and optically processed SAR image data available to the user community as of Aug. 1979. Results from several SAR workshops are mentioned. Author (ESA)

N81-18471# European Space Research and Technology Center, Noordwijk (Netherlands).
FINAL ACCEPTANCE OF THE MACDONALD DETTWILER AND ASSOCIATION SOFTWARE SYNTHETIC APERTURE RADAR PROCESSOR
J. P. Guignard *In* ESA SEASAT-SAR Processor 1980 p 91-100 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

The image characteristics resulting from using a SAR and acceptance test procedures are described. Measured were spatial and radiometric resolution, and integrated sidelobe ratio. Processor performance was measured with simulated input and real SEASAT imagery. These tests included performance at increased equivalent yaw, focus across a processor segment, dynamic range, spatial distribution of image points, absolute location of specified targets and processor throughput. The effect of beam offset from zero Doppler (equivalent yaw) was shown to be of importance in assessing the quality of SAR images. Author (ESA)

N81-18472# Communications Research Centre, Ottawa (Ontario).
THE COMMUNICATIONS RESEARCH CENTRE SYNTHETIC APERTURE RADAR PROCESSOR
M. R. Vant, G. E. Haslam, and W. E. Thorp (W. E. Thorp Assoc., Ltd.) *In* ESA SEASAT-SAR Processor 1980 p 101-112 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

A two dimensional, software based, digital synthetic aperture radar (SAR) processor capable of generating images from airborne or satellite-borne SAR's operating in either 'squinted' or 'sidelooking' modes is presented. This processor implements true two dimensional matched filtering, via two dimensional fast convolution. The process by which the range variation of the parameters of the SAR signal causes a mismatch between the filter and the data at the edges of the processing block is described. Provided the mismatch is not severe, the resultant image is in focus but contains geometric distortions that are removed later. The signal processor implementation is outlined and typical processing speeds are given. Images produced from the SEASAT-A SAR are presented. Author (ESA)

N81-18473# Royal Aircraft Establishment, Farnborough (England). Space Dept.
PRELIMINARY RESULTS FROM THE RAE DIGITAL PROCESSOR
G. E. Keyte *In* ESA SEASAT-SAR Processor 1980 p 113-125 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

An experimental facility for digitally processing data from the synthetic aperture radar (SAR) on SEASAT-A is described. The procedures for defining image parameters and high density digital tape start and finish times, for transferring raw data from high density tapes to computer compatible tape, and for processing raw data and output to an image tape are described. Data selection, range compression and azimuth compression techniques are given with processing times. Production methods of multilook and single look hard copy images are treated. Simulated raw data were generated from point targets and processed with the system for assessment of processor performance. Author (ESA)

N81-18474# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
MIDTERM REPORT ON THE TRANSFER OF MDA'S SEASAT SAR SOFTWARE PROCESSOR TO AN IBM COMPUTER FACILITY
G. Waller *In* ESA SEASAT-SAR Processor 1980 p 127-128 refs (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

Problems which occurred in transferring synthetic aperture radar (SAR) processing programs written for an INTERDATA 8/32 to an Amdahl 470V6/IMB3032 are listed. Minor problems resulting from the differences between INTERDATA extended FORTRAN and FORTRAN IV required some substitutions by PL/1 routines. Major discrepancies which may severely influence the SAR processing performance include the substitution or suppression of the program runtime-decision-loops for timesharing operation in multi-user computer systems and the realization of the INTERDATA specific Contiguous File structure for fast direct access disc input/output. Author (ESA)

N81-18475# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
STATUS OF THE MICROWAVE REMOTE SENSING EXPERIMENT (MRSE) PROJECT
F. Schlude, A. P. Wolframm, and M. Werner *In* ESA SEASAT-SAR Processor 1980 p 131-133 (For primary document see N81-18458 09-43)
Avail: NTIS HC A07/MF A01

The microwave remote sensing experiment (MRSE) to be used in Shuttle/Spacelab flights incorporates a synthetic aperture radar (SAR), a 2 frequency scatterometer and a radiometer mode. The status of the hardware production and the preparatory work for the use of the hardware during the first Spacelab mission are summarized. Mission objectives include delivery of high resolution radar imagery and demonstration of the two frequency technique for measuring ocean wave spectra from space. Instrument parameters are listed. Author (ESA)

N81-18476# California Univ., Los Angeles. Dept. of Earth and Space Sciences.
RESEARCH IN THE GEOSCIENCES RELATED TO RESOURCE ASSESSMENT Interim Progress Report
M. G. Kivelson 18 Jul. 1980 15 p refs
(Contract DE-AT03-79ER-10119)
(DOE/IR-10119/T1) Avail: NTIS HC A02/MF A01

Research progress is reported in the development of a field data acquisition and processing system for use in exploration geophysics. Analysis of seismic data from Imperial Valley and Mt. Etna and the genesis of uranium ore deposited are presented. DOE

N81-18477# Oak Ridge National Lab., Tenn.
COMMENTS ON LONG-TERM ASPECTS OF RENEWABLE VERSUS NONRENEWABLE RESOURCE SUBSTITUTION
H. E. Goeller 1980 15 p Presented at the Interciencia Workshop on Mater. for the Future, Kingston, Jamaica, 17-21 Nov. 1980
(Contract W-7405-eng-26)
(CONF-801158-1) Avail: NTIS HC A02/MF A01

Advantages and limitations of renewable resources as substitutes for nonrenewable resources are discussed, with particular emphasis on the longer term when economic resources of some of the more limited chemical elements will run out or will, or least, become too expensive to use except in absolutely necessary, nonsubstitutable uses. Renewable resources will continue to become available through natural processes, in some cases augmented by modern technology, but only at some maximum level. For example, the amount of hydroelectric power available in the world is determined by rainfall and topograhy. On the other hand, nonrenewable resources are generally regarded as being material sources that, once used, are gone forever. This is true for fossil fuels, where current demands are many orders of magnitude larger than rates of formation of new coal and petroleum. It is not true, however, for some of the atmospheric gases (e.g., nitrogen and argon) which are returned to the atmosphere either directly or through biological processes after use so that they are renewable resources. DOE

N81-18478# Stanford Univ., Calif.
GEOTHERMAL RESERVOIR ENGINEERING COMPUTER CODE COMPARISON AND VALIDATION USING THE GEONZ SIMULATOR PROGRAM
Roland N. Horne, D. O. Ogbe, K. Temeng, and H. J. Ramey, Jr. 14 Nov. 1980 67 p refs
(Contract DE-AC03-80SF-11450)

(DOE/SF-11450/1) Avail: NTIS HC A04/MF A01

It was originally proposed to use the GEOTHERM geothermal simulator program to prepare solutions to the first five of the six Department of Energy computer code comparison sets. Valid solutions were anticipated in all of the five problems attempted, but it was expected that problems 3 and 4 might present some difficulties. A more recent version of the program, called GEONZ became available and was used successfully on problems 3 and 4. The new program, GEONZ, had additional capabilities that enabled it to handle both superheated steam and counterflows of steam and water. The choice of the GEONZ code is discused, followed by an in depth description of the solutions obtained for problems 1 through 5. The five problems are: 1-D Avdonin Solution, 1-D well test analysis, 2-D flow in fracture/block medium, 2-D phase system with drainage, and flow in a 2-D areal reservoir. DOE

N81-18479# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.

THERMAL STUDIES IN A GEOTHERMAL AREA. REPORT 1: THERMAL STUDIES AT ROOSEVELT HOT SPRINGS, UTAH. REPORT 2: HEAT FLOW ABOVE AN ARBITRARILY DIPPING PLANE OF HEAT SOURCES. REPORT 3: A DATUM CORRECTION FOR HEAT FLOW MEASUREMENTS MADE ON AN ARBITRARY SURFACE

W. R. Wilson and D. S. Chapman Oct. 1980 151 p refs

(Contract DE-AC07-80ID-12079)

(DOE/ID-12079/19) Avail: NTIS HC A08/MF A01

Interpretation of heat flow data is presented for 53 drill holes. The temperature profiles are classified in three spatially consistent patterns which delineate hydrologic recharge, active convection and discharge regions. DOE

N81-18480# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.

EVALUATION AND TARGETING OF GEOTHERMAL ENERGY RESOURCES IN THE SOUTHEASTERN UNITED STATES Progress Report, 1 Oct. 1979 - 30 Jun. 1980

J. K. Costain Dec. 1980 298 p refs

(Contract DE-AC05-78ET-27001)

(DOE/ET-27001/8) Avail: NTIS HC A13/MF A01

Geological studies were conducted of the area including petrographic and stratigraphic analysis. Thermal mapping was used for possible site selection of geothermal energy power plants. Structural properties of the local geology are presented. T.M.

N81-18481 Maryland Univ., College Park.

ANALYSIS OF THE ORIGIN OF WATER WHICH FORMS LARGE AUFEIS FIELDS ON THE ARCTIC SLOPE OF ALASKA USING GROUND AND LANDSAT DATA Ph.D. Thesis

Dorothy Kay Hall 1980 137 p

Avail: Univ. Microfilms Order No. 8103882

Field and laboratory studies indicate that the water derived from aufeis meltwater has a chemical composition different from the adjacent upstream river water. The associatton of aufeis with springs and faults in the eastern Arctic Slope is indicative of a subterranean origin of the source water. In addition, large aufeis fields were not found to be strongly associated with breaks in channel gradient nor did aufeis extent follow meteorological patterns both of which would be indicative of a local origin of aufeis feed water. It is concluded that aufeis extent in a given river channel on the Arctic Slope is controlled by discharge from reservoirs of groundwater. It seems probable that precipitation passes into limestone aquifers in the Brooks Range through an interconnecting system of subterranean fractures in calcareous rocks and ultimately discharges into alluvial sediments on the coastal plain to form aufeis. It is speculated that only small (perhaps beaded) aufeis patches are affected by local meteorological conditons of the months just prior to aufeis formation. Dissert. Abstr.

N81-18482 Rensselaer Polytechnic Inst., Troy, N. Y.

A METHODOLOGY FOR THE DESIGN AND CALIBRATION OF DATA BASED MODELS OF AGGREGATE LAKE ECOSYSTEM DYNAMICS Ph.D. Thesis

Glenn Foster Roberts 1980 284 p

Avail: Univ. Microfilms Order No. 8103762

A methodology which makes use of both theory based on data based information to structure and calibrate low order dynamic models for lake ecosystem analysis is developed. This methodology is designed to be used with existing sparse ecosystem data sets. The methodology is applied to develop models of the aggregate response of Lake George, New York, and Lake Wingra, Wisconsin, to allochthonous loadings of nutrients. The important steps in this methodology are: (1) the conceptualization of the system in terms of interactions among key components; (2) the specification of simple difference equations to model these key interactions; (3) the estimation of unknown parameters using data based calibration techniques; and (4) the validation of the model in terms of overall fit and agreement with ecological theory. Dissert. Abstr.

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-18483 California Univ., Los Angeles.

MILITARY WASTES-TO-ENERGY APPLICATIONS Ph.D. Thesis

Keith Eichi Kawaoka 1980 275 p

Avail: Univ. Microfilms Order No. 8104006

Military waste material and byproduct stream and the potential for energy recovery and utilization are discussed. Feedstock material includes municipal-type solid waste, selected installation hazardous waste, and biomass residue. Objectives are: (1) analyze the characteristics of the military waste stream; (2) identify potential energy recovery options; and (3) examine and assess the technical and economic feasibility and environmental and institutional impacts of various energy recovery approaches. Benefits of waste-to-energy conversion are: (1) waste is utilized as a resource; (2) nonrenewable conventional fuels are conserved; (3) waste volume is reduced; (4) there are low sulfur oxide emissions from a combusted waste; (5) waste energy is a readily available and inexhaustible resource that reduces dependence on imported energy. Dissert. Abstr.

N81-18484 Virginia Polytechnic Inst. and State Univ., Blacksburg.

THE AERODYNAMIC ANALYSIS OF A 10 KW HORIZONTAL-AXIS WINDMILL Ph.D. Thesis

Reginald Lee Figard 1980 154 p

Avail: Univ. Microfilms Order No. 8101878

An aerodynamic study of the performance and the flowfield in the vicinity of the rotor of a three bladed 10kW, horizontal-axis windmill is presented. The windmill has a 6.38 m (20.92 ft) diameter rotor and is rated at 10kW in a 13.41m/s(44.0 fps) wnd. Three basic approaches are utilized. First, field measurements of the performance and the axial velocity and turbulence behind the rotor were conducted. Second, wind tunnel tests of a 1:5 scale model were performed. Third, theoretical analyses of the windmill were made. This included performance predictions with a computerized, modified blade element (vortex theory) analysis and the development and utilization of a numerical procedure employing the full Navier-Stokes equations in axisymmetric form to examine the wake development in detail. The results of each of the three approaches shows agreement within 10 to 15% with the other two approaches. The theoretical performance analysis underpredicts both the field and wind tunnel results while scaled-up wind tunnel results overpredicted the field results. The axial velocities immediately behind the rotor are compared for all three cases and the results correspond to the performance results. Dissert. Abstr.

N81-18485 Purdue Univ., Lafayette, Ind.

MATHEMATICAL PROGRAMMING APPLIED TO POWER

SYSTEMS EXPANSION PLANNING WITH PUMPED STORAGE Ph.D. Thesis
Enayat Ibrahim Hafez 1980 165 p
Avail: Univ. Microfilms Order No. 8102661

Power systems expansion planning problem may be decomposed into three separate sub problems, generation, transmission, and distribution planning. Essentially it is the capability expansion problem versus dispatching problem. The sub problem of generation expansion planning (capacity expansion planning) that can use pumped hydroelectric storage is discussed. The sub problem of capacity expansion planning can be completely solved without considering the transmission and distribution sub problems. A multipurpose hydrostorage (conventional and pumped hydroplants) was considered which is to meet the needs of irrigation, flood control, and recreation. A linear programming (LP) formulation was developed for power systems expansion planning which incorporates the pumped hydro along with the conventional power plants (hydro, nuclear, thermal, etc.). The pumped hydro will be expected to meet peak demands. The size of the LP model is reduced using the Z substitute method which results in a reduction of computational time.
Dissert. Abstr.

N81-18486 Alabama Univ., University.
HIGH TEMPERATURE THERMAL ENERGY STORAGE IN AQUIFERS WITH A SOLAR POWER PLANT APPLICATION Ph.D. Thesis
Jasem Mohammad Al-Ansari 1980 205 p
Avail: Univ. Microfilms Order No. 8100557

In this system, energy injection and withdrawal are accomplished by reversing flow through a system of wells connecting the aquifer to the surface. Each well contains a submerged pumping system and controls. Two computer programs have been developed for the proposed system. The first program computes the location of a fluid particle as it moves between the injection well and the withdrawal well for a given period of time. The second program computes the rate of heat transfer within the storage system during injection and withdrawal periods. The thermal energy storage system is analyzed in conjunction with a solar power plant system. The storage system provides energy during nighttime bad weather, and winter low insolation periods. The power plant system consists of a Rankine steam cycle, a two dimensional concentrating solar collector system, and the aquifer thermal energy storage system. The per kilowatt solar plant capital cost is approximately $10,000/kW. The storage system is only $40/kW of 0.4 percent of capital cost.
Dissert. Abstr.

N81-18487 California Inst. of Tech., Pasadena.
EXPERIMENTS WITH UNCOVENTIONAL CROSSFLOW HEAT EXCHANGERS Ph.D. Thesis
Edward Kenneth Ruth 1981 78 p
Avail: Univ. Microfilms Order No. 8104674

These experiments consisted of measurements of pressure losses and heat transfer rates for two unconventional crossflow heat exchanger configurations. The first type consisted of an arrangement of circular tubes in a sawtooth pattern. Performance of this type did not appear to be an improvement over more conventional heat exchangers. The second type used exchanger tubes of a special lenticular cross section so spaced as to keep the velocity of the fluid flowing outside the tubes nearly constant in magnitude reducing separation and drag. The lenticular tubes' performance was superior to the conventional types, especially at higher Reynolds numbers. Dissert. Abstr.

N81-18488 California Univ., Los Angeles.
EFFECT OF WALL SUCTION ON LAMINAR ENTRANCE FLOW WITH APPLICATION TO SOLAR AIR HEATERS Ph.D. Thesis
Seung Joon Rhee 1980 340 p
Avail: Univ. Microfilms Order No. 8104035

Numerical solutions are obtained for hydrodynamically and thermally developing steady-state laminar flow in a long rectangular cavity with uniform suction on one wall and uniform temperature or heat flux independently prescribed at each wal. Collection efficiencies for several solar air heaters are predicted by performing a system analysis. A two dimensional thermal system model is considered, where temperature variation along the direction of flow is allowed in each system element. Five selective black metal plate experimental solar air heaters with and without transpiration were designed, fabricated, and tested to compare their technical merits and to prove how well the theoretical results and system analysis predict performance of actual solar collectors. Discussion of the design of a full-scale selective black metal plate solar air heater with transpiration through slots is presented. Discussed are: (1) The number of teflon films for cover glazing assembly; (2) the spacing between glazing elements; (3) the spacing between the absorber plate and the inner glazing; and (4) the design of inlet and outlet manifolds. Dissert. Abstr.

N81-18489# Committee on Science and Technology (U. S. House).
REGIONAL SOLAR ENERGY CENTERS AND THE SOLAR ENERGY RESEARCH INSTITUTE
Washington GPO 1980 27 p Presented to the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., Jul. 1980
(GPO-57-234) Avail: Subcommittee on Energy Development and Applications

Hearings focused on the management methods and operations of the Regional Solar Energy Centers and the Solar Energy Research Institute. Serious questions were raised concerning the appropriate mission for the RSEC's and potential conflicts and overlap with existing programs were investigated. Economic factors were examined that affect funding policies. T.M.

N81-18490*# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
SATELLITE POWER SYSTEM (SPS) MAGNETRON TUBE ASSESSMENT STUDY
William C. Brown Feb. 1981 184 p refs
(Contract NAS8-33157)
(NASA-CR-3383; M-331) Avail: NTIS HC A09/MF A01 CSCL 10A

The data base was extended with respect to the magnetron directional amplifier and its operating parameters that are pertinent to its application in the solar power satellite. On the basis of the resulting extended data base the design of a magnetron was outlined that would meet the requirements of the SPS application and a technology program was designed that would result in its development. The proposed magnetron design for the SPS is a close scale of the microwave oven magnetron, and resembles it closely physically and electrically. T.M.

N81-18491*# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
DISK MHD GENERATOR STUDY Final Report
F. D. Retallick et al Oct. 1980 424 p refs
(Contract DEN3-139; DE-A101-77ET-10769)
(NASA-CR-159872; DOE/NASA/0139-1; AESD-TME-3064)
Avail: NTIS HC A18/MF A01 CSCL 10A

Directly-fired, separately-fired, and oxygen-augmented MHD power plants incorporating a disk geometry for the MHD generator were studied. The base parameters defined for four near-optimum-performance MHD steam power systems of various types are presented. The finally selected systems consisted of (1) two directly fired cases, one at 1920 K (2996F) preheat and the other at 1650 K (2500 F) preheat, (2) a separately-fired case where the air is preheated to the same level as the higher temperature directly-fired cases, and (3) an oxygen augmented case with the same generator inlet temperature of 2839 (4650F) as the high temperature directly-fired and separately-fired cases. Supersonic Mach numbers at the generator inlet, gas inlet swirl, and constant Hall field operation were specified based on disk generator optimization. System pressures were based on optimization of MHD net power. Supercritical reheat stream plants were used in all cases. Open and closed cycle component costs are summarized and compared. A.R.H.

N81-18492*# United Stirling A.B. Malmo (Sweden).
DESIGN STUDY OF A KINEMATIC STIRLING ENGINE FOR DISPERED SOLAR ELECTRIC POWER SYSTEMS Final Report, 1979 - 1980
1980 124 p refs
(Contract DEN3-56; EX-76-A-29-1060)

(NASA-CR-159588; DOE/NASA/0056-79/2) Avail: NTIS HC A06/MF A01 CSCL 10B

The concept evaluation shows that the four cylinder double acting U type Stirling engine with annular regenerators is the most suitable engine type for the 15 kW solar application with respect to design, performance and cost. Results show that near term performance for a metallic Stirling engine is 42% efficiency. Further improved components show an impact on efficiency of the future metallic engine to 45%. Increase of heater temperature, through the introduction of ceramic components, contribute the greatest amount to achieve high efficiency goals. Future ceramic Stirling engines for solar applications show an efficiency of around 50%. T.M.

N81-18493*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SOLAR POWER SATELLITE SYSTEM SIZING TRADEOFFS

G. D. Arndt and L. G. Monford Feb. 1981 44 p ref

(NASA-TP-1804; S-505) Avail: NTIS HC A03/MF A01 CSCL 10A

Technical and economic tradeoffs of smaller solar power satellite systems configured with larger antennas, reduced output power, and smaller rectennas, are considered. The differential costs in electricity for seven antenna/rectenna configurations operating at 2.45 GHz and five satellite systems operating at 5.8 GHz are calculated. Two 2.45 GHz configurations dependent upon the ionospheric power density limit are chosen as examples. If the ionospheric limit could be increased to 54 mW sq/cm from the present 23 mW sq/cm level, a 1.53 km antenna satellite operating at 2.45 GHz would provide 5.05 GW of output power from a 6.8 km diameter rectenna. This system gives a 54 percent reduction in rectenna area relative to the reference solar power satellite system at a modest 17 percent increase in electricity costs. At 5.8 GHz, an 0.75 km antenna providing 2.72 GW of power from a 5.8 km diameter rectenna is selected for analysis. This configuration would have a 67 percent reduction in rectenna area at a 36 percent increase in electricity costs. Ionospheric, atmospheric, and thermal limitations are discussed. Antenna patterns for three configurations to show the relative main beam and sidelobe characteristics are included. A.R.H.

N81-18494*# Westinghouse Research and Development Center, Pittsburgh, Pa.

CELL MODULE AND FUEL CONDITIONER Quarterly Report, Jul. - Sep. 1980

D. Q. Hoover, Jr. Oct. 1980 72 p

(Contracts DEN3-161; DE-AI03-79ET-11272)

(NASA-CR-165189; DOE/NASA/0161-5; Rept-80-9E6-MARED-R4; QR-4) Avail: NTIS HC A04/MF A01 CSCL 10A

Measurements of stack height changes with temperature and cell material characteristics were made. Stack 559 was assembled and components were fabricated for 560, 561, and 562. Stack 425 was transferred from the parallel DOE program and installed in the OS/IES simulation loop for mechanical and electrical testing. Construction and preliminary checkout of the 2 kW test facility was completed and design and procurement of the 8 kW test facility was initiated. The fuel conditioning subsystem design continued to evolve and the state points for the current design were calculated at full and part load conditions. Steam reforming catalyst activity tests were essentially completed and aging tests and CO shift converter tests were initiated. Author

N81-18495*# Solarex Corp., Rockville, Md.

COPLANAR BACK CONTACTS FOR THIN SILICON SOLAR CELLS Final Report, 24 Jul. 1978 - 15 Jul. 1980

G. Storti, A. Scheinine, D. Whitehouse, J. Wohlgemuth, C. Wrigley, and M. Giuliano Jan. 1981 38 p refs

(Contract NAS3-21250)

(NASA-CR-165272) Avail: NTIS HC A03/MF A01 CSCL 10A

The type of coplanar back contact solar cell described was constructed with interdigitated n(+) and p(+) type regions on the back of the cell, such that both contacts are made on the back with no metallization grid on the front. This cell construction has several potential advantages over conventional cells for space use namely, convenience of interconnects, lower operating temperatures and higher efficiency due to the elimination of grid shadowing. However, the processing is more complex, and the cell is inherently more radiation sensitive. The latter problem can be reduced substantially by making the cells very thin (approximately 50 micrometers). Two types of interdigitated back contact cells are possible, the types being dependent on the character of the front surface. The front surface field cell has a front surface region that is of the same conductivity type as the bulk but is more heavily doped. This creates an electric field at the surface which repels the minority carriers. The tandem junction cell has a front surface region of a conductivity type that is opposite to that of the bulk. The junction thus created floats to open circuit voltage on illumination and injects carriers into the bulk which then can be collected at the rear junction. For space use, the front surface field cell is potentially more radiation resistant than the tandem junction cell because the flow of minority carriers (electrons) into the bulk will be less sensitive to the production of recombination centers, particularly in the space charge region at the front surface. T.M.

N81-18496*# Stonehart Associates, Inc., Madison, Conn.

PREPARATION AND EVALUATION OF ADVANCED ELECTROCATALYSTS FOR PHOSPHORIC ACID FUEL CELLS Quarterly Report, Oct. - Dec. 1980

Paul Stonehart, John Baris, John Hochmutt, and Peter Pagliaro 31 Dec. 1980 35 p

(Contracts DEN3-176; DE-AL01-80ET-17088)

(NASA-CR-165245; DOE/NASA/0176-80/4; GR-4) Avail: NTIS HC A03/MF A01 CSCL 10A

Alloy electrocatalysts on carbon supports were developed for hydrogen oxidation in the presence of carbon monoxide. These electrocatalysts match the best platinum on carbon catalysts for performance yet cost half as much. The results demonstrate that a significant reduction in anode electrocatalyst material cost can be achieved by replacing the platinum. Since surface characterization of this catalyst is important to explain its performance, several approaches and pitfalls to the elucidation of the surface characterization are presented. T.M.

N81-18497*# National Bureau of Standards, Washington, D.C. Metallurgy Div.

NON-NOBLE CATALYSTS AND CATALYST SUPPORTS FOR PHOSPHORIC ACID FUEL CELLS Quarterly Report, Aug. - Nov. 1980

A. J. McAlister Nov. 1980 13 p refs

(NASA Order C-46229D; Contract DE-AL01-80ET-17088)

(NASA-CR-165221; DOE/NASA/6229-1; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

Tungsten carbide, which is known to be active for hydrogen oxidation and CO tolerant has a hexagonal structure. Titanium carbide is inactive and has a cubic structure. Four different samples of the cubic alloys Wx-1TixC were prepared and found to be active and CO tolerant. These alloys are of interest as possible phosphoric acid fuel cell catalysts. They also are of interest as opportunities to study the activity of W in a different crystalline environment and to correlate the activities of the surface sites with surface composition. Author

N81-18498*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

STATUS OF JPL'S EXPERIENCE WITH THIN 7809 GLASS FOR SOLAR ENERGY APPLICATIONS

F. L. Bouquet 1 Oct. 1980 25 p refs Revised Sponsored by DOE Prepared for Midwest Research Inst., Golden, Colo.

(Contract NAS7-100)

(NASA-CR-164005; JPL-Pub-80-96-Rev-A; DOE/JPL-1060-37; Rept-1) Avail: NTIS HC A02/MF A01 CSCL 10A

A shipment of advanced, high transmittance glass for solar thermal power applications is assessed. Results of both mirror and glass inspection are reported. Surface and bulk defects are identified as well as the number broken or chipped during shipment and handling. Of the panels received, the thicker 1.5 mm (0.060 in.) glass exhibited a smaller breakage rate than the thin 1.0 mm (0.040 in.) panels. S.F.

N81-18499# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.

HEAT EXCHANGE AND SOLAR ENERGY, VOLUME 1

1980 223 p refs Partly in ENGLISH and FRENCH Proceedings of 1980 Lecture Ser., Rhode-Saint-Genese, Belgium, 28 Jan. - 1 Feb. 1980 2 Vol.
(VKI-LS-1980-2-Vol-1) Avail: NTIS HC A01/MF A01

Lectures were presented surveying the heat transfer problems arising in connection with the collection, storage and utilization of solar energy. Special emphasis is given to the modeling of complete solar systems, including computer simulation of their transient response. For individual titles, see N81-18500 through N81-18506.

N81-18500# Mons Univ. (Belgium).
GENERAL INTRODUCTION TO THERMAL CONVERSION OF SOLAR ENERGY
J. Bougard *In* Von Karman Inst. for Fluid Dyn. Heat Exchange and Solar Energy, Vol. 1 1980 35 p refs (For primary document see N81-18499 09-44)
Avail: NTIS HC A10/MF A01

The daily distribution and monthly repartition of direct and diffuse solar energy is shown for Belgium. The thermodynamic limitations of thermal conversion are reviewed relative to solar heating and cooling systems. Optical systems, absorbers, and the global energy balance are discussed for thermal solar collectors. Energy flow charts shown are for several configurations of solar heating systems. Author (ESA)

N81-18501# Institut Royal Meteorologique de Belgique, Brussels. Radiometry Section.
METEOROLOGICAL DATA: MEASUREMENT TECHNIQUES AND SOLAR COMPONENTS
R. Dogniaux *In* Von Karman Inst. for Fluid Dyn. Heat Exchange and Solar Energy, Vol. 1 1980 28 p refs (For primary document see N81-18499 09-44)
Avail: NTIS HC A10/MF A01

The users of solar radiation data are identified and their respective accuracy requirements are given. Quantities and units are defined for direct, diffuse and global solar radiation measurements, and for long wave radiation flux. Techniques for estimating solar radiation data from sunshine hourly data are mentioned, and for deriving mean radiation components from parameters associated with the astronomical coordinates of the Sun, the geographical coordinates of the station, and atmospheric turbidity. Author (ESA)

N81-18502# Mons Univ. (Belgium).
METEOROLOGICAL DATA: TREATMENT OF RADIATION DATA, TEST REFERENCE YEAR
Andre Pilatte and Philippe Nicolas *In* Von Karman Inst. for Fluid Dyn. Heat Exchange and Solar Energy, Vol. 1 1980 29 p Sponsored by EEC and Belgium Ministry of Scientific Policy (For primary document see N81-18499 09-44)
Avail: NTIS HC A10/MF A01

A test reference year (TRY) is defined as a set of real measured hourly values for dry temperature, for global, diffuse and direct normal solar radiation, and for wind velocity. The data are in true sequence within each month. The months are selected from a multiple year data set of observations for a given location such that the resulting TRY is typical for the location. Three methods for selecting a TRY are outlined. One is purely statistical, the second depends on manual evaluation of data by a meteorologist, and the third depends on the effects of input data on a given system, (a building or a domestic hot water system). Each method is used to select a TRY and a climatological evaluation is performed with a solar heating system simulation program SYS4. The methods generate usable TRYS, with the statistical method costing the least. Author (ESA)

N81-18503# Joint Research Centre of the European Communities, Ispra (Italy).
THERMAL PROCESSES IN FLAT PLATE SOLAR COLLECTORS
E. Aranovitch *In* Von Karman Inst. for Fluid Dyn. Heat Exchange and Solar Energy, Vol. 1 1980 49 p (For primary document see N81-18499 09-44)
Avail: NTIS HC A10/MF A01

Heat losses from radiation, natural convection and from conduction in nonfocusing flat plate collectors are described and evaluated. The fin and bond effect is discussed and a method is shown for deriving the temperature profile in an aluminum fin. The principles of radiation transmission through transparent covers are reviewed, including Fresnel reflections at interfaces, and absorption coefficients within material. Methods for calculating heat losses and efficiency of a collector are shown. Methods for improving transmittance of covers are mentioned, including use of double glass, selective surfaces, and honeycomb structures between the cover and the absorber plate. Author (ESA)

N81-18504# Joint Research Centre of the European Communities, Ispra (Italy).
DESCRIPTION AND THERMAL PERFORMANCE OF CORRUGATED SOLAR COLLECTORS [DESCRIPTION ET PERFORMANCES THERMIQUES DE COLLECTEURS SOLAIRES A CORRUGATIONS]
P. Colaiemma (ALUMETAL), X. Micheletti (ALUMETAL), E. Aranovitch, F. Farfaletti, M. Ledet, and C. Roumengous *In* Von Karman Inst. for Fluid Dyn. Heat Exchange and Solar Energy, Vol. 1 1980 21 p In FRENCH (For primary document see N81-18499 09-44)
(Contract ISPRA-145-75-PIPGI)
Avail: NTIS HC A10/MF A01

Full scale tests were conducted of a flat plate solar collector fabricated from modular aluminum extrusions. The anodized extruded backplates contained integral fluid tubes and triangular corrugations. Plates painted black, brown, and green were evaluated at entry temperatures between 40 C and 90 C, and were found to be of nearly equal efficiency. Anodized plates were 40% more efficient. Curves are shown for monochromatic reflectance as a function of length of anodizing treatment. The extrusion profile tested presented a nonnegligible thermal resistance. Author (ESA)

N81-18505# Calabria Univ., Cosenza (Italy).
ADVANCED SOLAR COLLECTORS (CONCENTRATING TROUGHS)
Orazio A. Barra, L. Franceschi, and E. Pugliese Carratelli *In* Von Karman Inst. for Fluid Dyn. Heat Exchange and Solar Energy, Vol. 1 1980 31 p refs (For primary document see N81-18499 09-44)
Avail: NTIS HC A10/MF A01

The optical characteristics of short focus and long focus parabolic troughs are listed. A statistical analysis of the photothermal conversion and thermal losses of a cylindrical pipe and a cavity receiver is made. A steady state heat transfer equation is used to perform a dynamic analysis of the temperature profiles of the fluid flowing inside the receivers. Finite difference methods are employed to solve the equation with boundary conditions supplied by statistical analysis and with experimental data to estimate the equation parameters. Solutions for several physical and geometrical variants are discussed. Parabolic trough solar plant designs are given. Author (ESA)

N81-18506# Calabria Univ., Cosenza (Italy).
A NATURAL CONVECTION SOLAR HOUSE SYSTEM
O. A. Barra, E. Pugliese Carratelli, and G. Salzano (Rome Univ.) *In* Von Karman Inst. for Fluid Dyn. Heat Exchange and Solar Energy, Vol. 1 1980 16 p refs (For primary document see N81-18499 09-44)
(Contract CNR-78-02438.07)
Avail: NTIS HC A10/MF A01

An instrumented house heated by air circulated past a south facing wall was constructed and a computer model prepared to simulate the operation of the system. The wall was thermally decoupled from the collector, and a thin metal absorber plate introduced between the transparent cover and the wall. The absorber radiated from both sides in the naturally circulating air flow. The model supplied a synthetic series of hourly values of direct and diffused solar radiation and external ambient temperature, assuming a statistical distribution of historical data of the site. Some graphical model results are given. Author (ESA)

N81-18507# Ames Lab., Iowa. Dept. of Physics and Architecture.
EFFECT OF DESIGN PARAMETER CHANGES ON THE THERMAL PERFORMANCE OF A TRANSWALL PASSIVE SOLAR HEATING SYSTEM
J. R. Hull, J. F. McClelland, L. Hodges, J. L. Huang, R. Fuchs,

and D. A. Block 1980 5 p refs Presented at the 5th Natl. Passive Solar Conf., Amherst, Mass., 22-26 Oct. 1980
(Contract W-7405-eng-82)
(IS-M-299; CONF-801016-18) Avail: NTIS HC A02/MF A01

Thermal performance data for a prototype Transwall system in a passive test room are analyzed and used to revise and validate a thermal network model of the Transwall system. The mathematical model is used to predict Transwall thermal performance as a function of design parameters in an hour by hour simulation throughout the heating season for the climates of Boston, Madison, and Albuquerque. System parameters are varied one at a time, holding all other parameters at the values for a standard reference design. The Transwall design parameters varied are: collector area to building load ratio; Transwall thickness; transmittance of the absorber plate; and amount of internal thermal mass. The solar savings fraction is calculated for each condition and compared to that of the reference design in a graphical presentation. Thermal performance is obtained while allowing substantial design flexibility to achieve a viable system. DOE

N81-18508# Battelle Pacific Northwest Labs., Richland, Wash.
EVALUATION OF FUSION-FISSION ENERGY SYSTEMS
C. E. Willingham and W. E. Bickford Oct. 1980 8 p refs Presented at the 4th ANS Topical Meeting on the Technol. of Controlled Nucl. Fusion, King of Prussia, Pa., 14 Oct. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8527; CONF-801011-73) Avail: NTIS HC A02/MF A01

The goal of the Nonproliferation Alternative Systems Assessment Program (NASAP) is to provide recommendations in the development of nuclear energy systems which have potential for reducing the risk of nuclear weapons proliferation while satisfying the short and long term needs for nuclear energy. The fusion-fission hybrid is one of the nuclear energy systems which have been considered for long term applications. Information needed to evaluate and analyze hybrid for the NASAP is presented. Although most of the combined driver-blanket hybrid systems considered are not optimized for performance and cost, the resulting data provides valuable insights into future potential hybrids. DOE

N81-18509# Mississippi State Univ., Mississippi State. Dept. of Mechanical Engineering.
DEVELOPMENT OF A SYSTEM FOR OFF-PEAK ELECTRICAL ENERGY USE BY AIR CONDITIONERS AND HEAT PUMPS
Lynn D. Russell May 1980 61 p refs
(TVA-EDT-122; MSSU-EIRS-MS-80-1) Avail: NTIS HC A04/MF A01

Investigation and evaluation of several alternatives for load management for the TVA system are described. Specific data for the TVA system load characteristics were studied to determine the typical peak and off peak periods for the system. The alternative systems investigated for load management included gaseous energy storage, phase change materials energy storage, zeolite energy storage, variable speed controllers for compressors, and weather sensitive controllers. After investigating these alternatives, system design criteria were established; then, the gaseous and PCM energy storage systems were analyzed. The system design criteria include economic assessment of all alternatives. Handbook data were developed for economic assessment. A liquid/PCM energy storage system was judged feasible. DOE

N81-18510# Oak Ridge National Lab., Tenn.
US DEPARTMENT OF ENERGY THERMAL ENERGY STORAGE PROGRAM
James F. Martin 12 Nov. 1980 16 p refs Presented at the Intern. Conf. on Thermal Storage in Buildings, Toronto, 12 Nov. 1980
(Contract W-7405-eng-26)
(CONF-801154-1) Avail: NTIS HC A02/MF A01

The overall DOE program for energy conservation in space heating and cooling, in industrial waste heat utilization, and in power generation through the use of thermal energy storage (TES) and the ORNL activities for building heating and cooling uses and industrial uses of TES are discussed. It is concluded that the DOE TES program is both comprehensive and of significant size and that demonstration projects within the program will show a favorable commercialization potential for TES. DOE

N81-18511# Midwest Research Inst., Golden, Colo.
DIRECT CONTACT HEAT TRANSFER FOR THERMAL ENERGY STORAGE
John D. Wright Nov. 1980 6 p refs Presented at the 5th Ann. Thermal Storage Meeting, McLean, Va., 10 Oct. 1980
(Contract DE-AC02-77CH-00178)
(SERI/TP-631-838; CONF-801055-7) Avail: NTIS HC A02/MF A01

Direct contact heat exchange offers the potential for increased efficiency and lower heat transfer costs in a variety of thermal energy storage systems. Models of direct contact heat transfer based on literature information identified dispersed phase drop size, the mechanism of heat transfer within the drop, and dispersed phase holdup as the parameters controlling direct contact system performance. Tests were defined and equipment constructed to provide independent determination of drop size, heat transfer mechanism, and hold up. Experiments with heptane dispersed in water are described. The velocity at which drop formation changes from dropwise to jetting was overpredicted by all literature correlations. Further experiments are needed to conclusively determine whether the salt in a salt hydrate melt acts to block internal circulation. In addition, the potential of low temperature oil/salt hydrate latent heat storage systems is evaluated in the laboratory. DOE

N81-18512# Centro Informazioni Studi Esperienze, Milan (Italy).
OPTIMIZED DESIGN OF TOTAL ENERGY SYSTEMS: THE RETE PROJECT
P. Alia, F. Dallavalle, C. deNard, F. Sanson, S. Veneziani (Arienda Gas Acqua Consorziale, Reggio Emilia), and G. Spagni (Arienda Gas Acqua Consorziale, Reggio Emilia) 12 May 1980 40 p refs Presented at the 4th Intern. Conf. of Urban Heating, Sirmione, Italy, 12-15 May 1980
(CISE-1606; CONF-8005120-1) Avail: NTIS HC A03/MF A01

The RETE (Reggio Emilia Total Energy) project is discussed. The total energy system (TES) was developed to achieve the maximum quality matching on the thermal energy side between plant and user and perform an open scheme on the electrical energy side by connection with the Italian electrical network. The most significant qualitative considerations at the basis of the plant economic energy optimization and the selection of the operating criterion most fitting the user consumption characteristics and the external system constraints are reported. The design methodology described results in a TES that: in energy terms achieves a total efficiency evaluated on a yearly basis to be equal to about 78 percent and a fuel saving of about 28 percent and in economic terms allows a recovery of the investment required as to conventional solutions, in about seven years. DOE

N81-18513# Hawaiian Dredging and Construction Co., Honolulu.
ENGINEERING AND ECONOMIC STUDIES FOR DIRECT APPLICATIONS OF GEOTHERMAL ENERGY IN AN INDUSTRIAL PARK IN PAHOA, HAWAII Quarterly Technical Progress Report
15 Oct. 1980 7 p
(Contract DE-AC03-79ET-27233)
(DOE/ET-27233/T2; QTPR-4) Avail: NTIS HC A02/MF A01

The use of geothermal heat for industrial applications is discussed in terms of economic and technical feasibility. It is concluded that a direct heat geothermal industrial park located near Pahoa, Hawaii appears feasible. DOE

N81-18514# Land (Peter), Chicago, Ill.
DEVELOPMENT OF ECONOMIC HOUSE TYPE BASED UPON PASSIVE SOLAR ENERGY UTILIZATION AND ENERGY CONSERVATION FOR HIGH DENSITY URBAN PLANNING
1980 16 p
(Contract DE-FG02-79R5-10104)
(DOE/R5-10104/1) Avail: NTIS HC A02/MF A01

House types and their corresponding nesting patterns for high density, low rise urban neighborhoods are described which have the following characteristics: utilize the Sun for warming in winter, self cool in summer, conserve energy, low building

cost and ingracture costs, and efficiently use land. Implementing these criteria produces a range of about 25 designs and proposals for neighborhoods using them. Designs included are one story, two story, and split level. Basic house forms are determined. A precision model of one complete 800 unit neighborhood proposal is discussed. DOE

N81-18515# First Manufactured Homes, Inc., Lubbock, Tex.
PASSIVE AND HYBRID SOLAR MANUFACTURED HOUSING AND BUILDINGS
15 Sep. 1980 217 p
(Contract DE-EC02-80CS-30371)
(DOE/CS-30371/1) Avail: NTIS HC A10/MF A01

The eleven Conceptual Options, three Preliminary Designs for the Technical Review and three types of thermal storage that could be used with any of the three plans are included. Also, the appropriate thermal calculations, life cycle cost, cost estimates and market analysis are included. GRA

N81-18516# Motorola, Inc., Phoenix, Ariz.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN FILM SILICON SOLAR CELLS Final Report, 30 Jun. 1979 - 29 Jun. 1980
B. L. Sopori Nov. 1980 188 p refs
(Contract DE-AC01-79ET-23104)
(DOE/ET-23104/T1) Avail: NTIS HC A09/MF A01

Appropriate measurement techniques to facilitate a quantitative study of the electrical activity of structural defects were developed with respect to generation recombination, barrier height, and grain boundary conductivity. Grain boundaries were characterized in terms of physical properties such as angle of misfit and local stress. The influence of solar cell processing on the electrical behavior of structural defects and grain boundaries was determined. Polycrystalline solar cell performance was evaluated. R.C.T.

N81-18517# Engineering Societies Commission on Energy, Inc., Washington, D. C.
***REGIONAL CONVERSION TO COAL* Final Report**
Michael L. McKimmey Mar. 1980 119 p refs
(Contract EF-77-C-01-2468)
(FE-2468-63) Avail: NTIS HC A06/MF A01

An investigation of powerplant coal conversion is described and the options and problems confronting a group of electric utility companies in an example region were examined. The region selected for the study was New England, but the analysis format is valid for other regions having different specific conditions but facing the same general conversion mandates. The report concludes that because of its physical characteristics, simple conversion to coal of a utility steam boiler unit designed for oil or gas is not feasible. Boiler replacement of pre boiler coal liquefaction or gasification would be required to make the conversion to coal. Coal oil mixture combustion is a promising concept for the partial displacement of oil that could have significant application in New England. Coal derived synthetic boiler fuels, primarily liquids, could play a significant role in the conversion of existing units, but their availability in sufficient quantities by 1990 is doubtful. The region's indigenous coal and hydropower resources are not expected to impact the energy mix by 1990, if ever. DOE

N81-18518# Brookhaven National Lab., Upton, N. Y.
FUEL-CELLS FOR ELECTRIC UTILITY AND TRANSPORTATION APPLICATIONS
S. Srinivasan 1980 22 p refs Presented at 5th Australian Electrochem. Conf., Perth, Australia, 18 Aug. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28696; CONF-800883-1) Avail: NTIS HC A02/MF A01

The current status and expected progress status of the fuel cell research and development programs in the USA, electrochemical problem areas, techno-economic assessments of fuel cells for electric and/or gas utilities and for transportation, and other candidate fuel cells and their applications are presented. For electric and/or gas utility applications the most likely candidates are phosphoric, molten carbonate, and solid electrolyte fuel cells. The first will be coupled with a reformer (to convert natural gas, petroleum-derived, or biomass fuels to hydrogen), while the second and third will be linked with a coal gasifier. A fuel cell/battery hybrid power source is an attractive option for electric vehicles with projected performance characteristics approaching those for internal combustion or diesel engine powered vehicles. For this application, with coal-derived methanol as the fuel, a fuel cell with an acid electrolyte is essential: with pure hydrogen, alkaline fuel cells show promise. DOE

N81-18519# Pennsylvania State Univ., University Park.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN FILM SILICON SOLAR CELLS Technical Summary Report, 31 Jul. 1979 - 31 Mar. 1980
T. A. Temofonte, J. R. Szedon, H. C. Dickey, S. J. Fonash, S. Ashok, and P. A. Lester 11 Jul. 1980 35 p refs Prepared in cooperation with Westinghouse Research and Development Center
(Contract DE-AC01-79ET-23106)
(DOE/ET-23106/3) Avail: NTIS HC A03/MF A01

Fundamental aspects of grain boundary influences on photocurrent collection and opposing current transport in polycrystalline silicon cells were studied. Results are expected to aid in optimizing thin film polycrystalline silicon solar cells. Three major tasks are addressed: a modeling, measurement technique development, and characterization and control of grain boundaries in polycrystalline silicon. Progress is reported. DOE

N81-18520# Midwest Research Inst., Golden, Colo. Solar Thermal, Ocean, and Wind Div.
OMNIUM-G PARABOLIC DISH OPTICAL EFFICIENCY: A COMPARISON OF TWO INDEPENDENT MEASUREMENT TECHNIQUES
M. Bohn and H. Gaul Oct. 1980 16 p refs
(Contract DE-AC02-77CH-00178)
(SERI/TR-631-544) Avail: NTIS HC A02/MF A01

Measurements made at SERI of the optical efficiency of the Omnium-G parabolic dish concentrator are described. Two independent techniques are emphasized: the cold water calorimeter method; and the heat of fusion method. Results from both techniques indicate that the optical efficiency for a 10 cm receiver aperture is 25 percent. An optical alignment procedure is described that resulted in the increase in optical efficiency from 21 percent to the current value of 25 percent. DOE

N81-18521# Institute of Gas Technology, Chicago, Ill.
ELECTROCHEMICAL PHOTOVOLTAIC CELLS Quarterly Technical Progress Report, 1 Aug. - 31 Oct. 1980
Peter G. P. Ang and A. F. Sammells Dec. 1980 22 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-9175-1-T2) Avail: NTIS HC A02/MF A01

Experimental approaches for electrochemical photovoltaic cells that not only show promise of high power conversion efficiencies but also have the potential to achieve long life and the capacity for energy storage were identified. The work is organized as follows: selection of high efficiency semiconductor photoelectrode/electrolyte systems; development of long life electrochemical photovoltaic cells; development of an all solid state electrochemical photovoltaic cell with in situ storage; and demonstration of laboratory size photoelectrochemical cell with redox storage. This program is directed toward identifying a suitable match between the proposed semiconductor and the redox species present in aqueous, nonaqueous, and solid electrolytes for achieving the necessary performance and semiconductor stability requirements. Emphasis is on aqueous electrolyte based systems where fast kinetics are favored. The proposed systems will be compatible with convenient storage of the electroactive species generated and their later electrochemical discharge in a redox cell. DOE

N81-18522# Battelle Pacific Northwest Labs., Richland, Wash.
BARSTOW HELIOSTAT MIRROR GLASS CHARACTERIZATION
M. A. Lind and C. Q. Buckwalter Sep. 1980 40 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3576) Avail: NTIS HC A03/MF A01

The technical analysis performed on the special run of low iron float glass for a ten megawatt solar thermal/electric pilot power plant is discussed. The topics that are addressed include the optical properties and the relative durability of the glass. Two optical parameters, solar transmittance and optical flatness,

were measured as referenced in the specification and found to be better than the stated tolerances. The average solar transmittance exceeded 0.890 transmittance units. The glass also exhibited optical angular flatness deviations less than + or - 1.0 mrad as required. Both qualitative and quantitative accelerated weathering tests were performed on the glass in order to compare its durability to other soda lime float glass and alternate composition glasses of interest to the solar community. In both the quantitative leaching experiments and the more qualitative room temperature and elevated temperature water vapor exposure experiments the heliostat glass exhibited the same characteristics as the other soda lime silicate float glasses. DOE

N81-18523# Midwest Research Inst., Golden, Colo.

SOLAR CENTRAL RECEIVER SYSTEMS COMPARATIVE ECONOMICS

P. J. Eicker Apr. 1980 9 p refs Presented at Solar Central Receiver Semiann. Rev. Meeting, Williamsburg, Va., 11 Sep. 1979

(Contract DE-AC02-77CH-00178)

(SERI/SP-633-637; CONF-7909189-1) Avail: NTIS HC A02/MF A01

Several major conceptual design studies of solar central receiver systems and components were completed in the last year. The results of these studies were used to compare the projected cost of electric power generation using central receiver systems with that of more conventional power generation. The cost estimate for a molten salt central receiver system is given. Levelized busbar energy cost is shown as a function of annual capacity factor indicating the fraction of the cost due to each of the subsystems. The estimated levelized busbar energy cost for a central receiver (70 to 90 mills per kilowatt hour) is compared with the levelized busbar energy cost for a new coal fired Rankine cycle plant. Sensitivities to the initial cost of coal and the delta fuel escalation are shown. DOE

N81-18524# Department of Energy, Washington, D. C.

REDUCING US OIL VULNERABILITY: ENERGY POLICY FOR THE 1980'S

10 Nov. 1980 40 p

(DOE/PE-0021) Avail: NTIS HC A03/MF A01

Current Federal energy policies and programs are asked in light of recent events and in light of what are believed to be the most reliable available projections of the future. Additional steps are outlined that could reduce our vulnerability to an oil import disruption during the next decade. Specifically, the study seeks to answer three questions: as a base case, what levels of US energy consumption, production, and imports might we anticipate for 1985 and 1990 under existing statutes, policies, and programs; considering both our own and our allies dependence on oil imports, how vulnerable does this leave the United States to foreign supply disruptions; considering the likely effects of government policies and programs which already exist to reduce our vulnerability (through reduction of US oil imports or by any other means), are there additional initiatives that could be undertaken to give us greater protection - especially between now and 1990. DOE

N81-18525# AeroChem Research Labs., Inc., Princeton, N. J.

RATE COEFFICIENTS OF COMBUSTION/FUEL CONVERSION REACTIONS BY HIGH-TEMPERATURE PHOTOCHEMISTRY Progress Report, 1 Sep. 1979 - 31 Aug. 1980

William Felder Sep. 1980 17 p refs

(Contract DE-AC02-77ER-04169)

(COO-4169-5; AeroChem-TN-214) Avail: NTIS HC A02/MF A01

Reliable kinetic data on isolated elementary combustion reactions spanning a broad temperature range are required for modeling and scaling studies aimed at improving the performance of, and reducing the pollutant formation from fossil fuel burning devices. High temperature photochemistry was developed to provide such data. It combines the technology of the high temperature, fast flow reactors developed to study kinetics of metal atom/oxide reactions in the 300 to 1900 K range with the methodology of the flash photolysis technique which, although used widely for study of such combustion reactions, was limited to studies at or near room temperature. DOE

N81-18526# California Univ., Livermore. Lawrence Livermore Lab.

WIND-POWER SITE-SCREENING METHODOLOGY Final Report

J. J. Walton, C. A. Sherman, and J. B. Knox Oct. 1980 66 p refs

(Contract W-7405-eng-48)

(UCRL-52938) Avail: NTIS HC A04/MF A01

Principal components analysis techniques for classifying types of regional flow fields and a three dimensional diagnostic flow model were blended into a rotational for screening wind sites in the presence of complex terrain. Relevant contributing capabilities, the developed screening methodology, the prospectors' preliminary wind resource maps for the island of Oahu generated to guide the development of the observationsl network, and the data base developed for testing are described. The use of the methodology on the island of Oahu is illustrated and two annual assessments of Oahu's wind energy potential are described. DOE

N81-18527# Tennessee Univ., Knoxville. Dept. of Mathematics.

OBSERVATION ON THE TOTAL ENERGY OF A SYSTEM WITH PHASE CHANGES

V. Alexiades, A. A. Solomon (ORNL), and D. G. Wilson (ORNL) Jan. 1981 18 p refs

(Contract W-7405-eng-26)

(ORNL/CSD-72) Avail: NTIS HC A02/MF A01

In most heat transfer processes the choice of a reference energy and reference temperature are arbitrary, since only differences in energy and temperature are relevant to the transfer process. Thus, in applications to thermal energy storage, the total energy of a system will be obtained by integrating the temperature drop relative to an arbitrary reference temperature. The integral of the temperature drop will not yield a physically relevant total energy in a system with a phase change unless the reference point is chosen in a particular fashion. Indeed, conservation of energy constrains the choice of the melt temperature of the material as the reference point in a simple phase change process, while for multiple phase changes (as in iron), or variable melting temperatures (as in the solidification of an alloy), energy conservation places severe restrictions on the choice of the reference point. DOE

N81-18528# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

ECONOMIC APPLICATION, DESIGN ANALYSIS, AND MATERIAL AVAILABILITY FOR CERAMIC HEAT EXCHANGERS

V. J. Tennergy Jan. 1981 74 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7580) Avail: NTIS HC A04/MF A01

Fuel consumption in an industrial process can be reduced by 40% or more by using recuperation or regeneration to heat air for the burners compared with use of ambient temperature air for fuel combustion with furnace gases in the range of 1300 C and air preheat temperatures above 800 C. Alloy temperature limitations and corrosion of the alloys severely limit the use of metal recuperators to preheat air above about 600 C. Structural ceramics, such as silicon carbide, offer promise for use in high-temperature HXs for recovering waste heat from hot flue gases. An assessment was made of industrial attitudes toward advanced high-temperature ceramic recuperators. Three promising industrial processes are identified where these recuperators could be applied. Conceptual designs of ceramic recuperators are given consistent with the furnace requirements for these processes. The annual national fuel saving possible for the three applications of these recuperators was estimated. DOE

N81-18529# Physical Sciences, Inc., Woburn, Mass.

TASK REPORT NO. 3. SYSTEMS ANALYSIS OF ORGANIC RANKINE BOTTOMING CYCLES

D. Bloomfield and S. Fried Dec. 1980 62 p refs

(Contract DE-AC21-80MC-14361)

(PSI-TR-245) Avail: NTIS HC A04/MF A01

A model was developed that predicts the design performance and cost of a Fuel Cell/Rankine cycle powerplant. The Rankine cycle utilizes the rejected heat of an 11.3 MW phosphoric acid fuel cell powerplant. Improvements in the total plant heat rate

and efficiency of up to 10% were attainable, using ammonia as the working fluid. The increase in total plant cost divided by the increase in total plant power ranged from $296/kW to $1069/kW for the cases run, and was a strong function of ambient temperature. The concept appears to be capable of producing substantial energy savings in large fuel cell powerplants, at reasonable costs. However, a much more detailed study that includes such factors as duty cycle, future cost of fuel and site meteorology needs to be done to prove the design for any potential site. DOE

N81-18530# Rockwell International Science Center, Thousand Oaks, Calif. Electronics Research Center.
***GALLIUM ARSENIDE PHOTOVOLTAIC DENSE ARRAY FOR CONCENTRATOR APPLICATIONS* Final Report**
J. A. Cape Dec. 1980 108 p refs
(Contract DE-AC04-76DP-00789)
(SAND-78-7056) Avail: NTIS HC A06/MF A01

The feasibility of operating a photovoltaic subsystem on a solar central receiver was explored with emphasis on the possible application of the photovoltaic device as part of a compound receiver for cogeneration of heat and electricity, a so-called total energy system. Progress is reported in the design, performance, and testing of a dense array of GaAs concentrator cells. Specific requirements for the array design were: (1) achieve 16% array efficiency (including area losses) at 1000 SUNs; (2) yield a working output voltage between 220 to 300 volts; (3) have integral heat sinking optimized for efficient total energy utilization; (4) meet the test conditions of 25(0) to 180(0)C and 50 to 1500 SUNs; (5) have a modular structure so that larger units could be built up; (6) be compatible with CRTF test system (coolant loop, and optical acceptance angle, etc.); and (7) be protected against shorts, shadowing, individual cell open circuit failure and load fluctuations. Progress is reported including design, performance, and testing details. DOE

N81-18531# Sargent and Lundy, Engineers, Chicago, Ill.
COMPRESSED AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER, TASK 2. VOLUME 2: CHARACTERIZE AND EXPLORE POTENTIAL SITES AND PREPARE RESEARCH AND DEVELOPMENT PLAN
Dec. 1980 431 p refs Sponsored in part by Electric Power Research Inst.
(Contracts DE-AC02-78ET-29232; ET-78-C-01-2159)
(DOE/ET-29232/T1-Vol-2) Avail: NTIS HC A19/MF A01

The characteristics of sites in Indiana and Illinois which are being investigated as potential sites for compressed air energy storage power plants are documented. These characteristics include geological considerations, economic factors, and environmental considerations. Extensive data are presented for 14 specific sites and a relative rating on the desirability of each site is derived. DOE

N81-18532# Foster-Miller Associates, Inc., Waltham, Mass.
DEVELOPMENT OF AN AUTOMATIC HELIOSTAT CLEANING SYSTEM Final Technical Report
Paul Tremblay and Elizabeth Poulin Dec. 1980 120 p refs
(Contract DE-AC04-79DP-00789)
(SAND-79-8184; SAN-7908) Avail: NTIS HC A06/MF A01

An automatic washing system was designed consisting of a water treatment system, a pressurized underground water distribution system, an automatic spray washing module for each heliostat, a water collection system, and appropriate controls to operate this equipment. In order to determine the required values for the various washing parameters, a series of washing tests was undertaken in which mirrors were soiled and then cleaned by a high pressure water spray. Reflectivity was measured for the clean, soiled and washed conditions to determine the effectiveness of the cleaning. A heliostat spray module was constructed and operated mainly to obtain information on the mechanical operation of one concept. This testing showed that this system was generally satisfactory, but did show some areas for improvement. Water distribution and waste water systems were designed and evaluated with the main conclusion that conventional waste water collection is complex and the most expensive part of the system. DOE

N81-18533# Hughes Research Labs., Malibu, Calif.
INDIUM PHOSPHIDE/CADMIUM SULFIDE THIN-FILM SOLAR CELLS Final Report, May 1979 - Jul. 1980
K. Zanio Sep. 1980 71 p refs
(Contract DE-AC02-77CH-00178)
(SERI/TR-8170-1-T2) Avail: NTIS HC A04/MF A01

Thin-film InP/RXCdS/ITO/GLASS devices were prepared by depositing ITO on low-cost glass substrate, depositing CdS on the ITO by thermal evaporation, increasing the CdS lateral grain size by recrystallization, and depositing p-type InP by planar reactive deposition (PRD) on the recrystallized CdS (RXCdS). Yields of the RXCdS/ITO/GLASS substrates were increased to 90% with lateral dimensions of the RXCdS grains as large as 0.3 mm. P-type InP layers were obtained with Be doping. S-doping via vapor transport from the CdS was eliminated by capping the entire RXCdS substrate with InP. For InP deposited on RXCdS at 380 C, devices showed blocking action with a barrier height of about 0.5 V but no light response, possibly due to an intermediate approx. 3 micrometers thick n-InP layer from diffusion of S from the RXCdS. These results were achieved despite poor InP epitaxy due to an approx. 0.5 micrometer-thick In-Cd-S transition layer between the InP and the RXCdS. InP films were subsequently deposited on RXCdS at the reduced substrate temperature of 280 C to reduce S-diffusion and improve the quality of the epitaxy. DOE

N81-18534# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
USER'S GUIDE TO MONTHLY PERFORMANCE REPORTS FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Jun. 1980 46 p
(Contract DE-AC01-79CS-30027)
(SOLAR/0004-80/18) Avail: NTIS HC A03/MF A01

Individual sections of the Monthly Performance Report, intent of each section, and parameters used to characterize site solar energy system performance are included. Background information on the subsystems and design features affecting solar energy collection, storage, and distribution to building thermal load requirements in active and passive solar sites are discussed. An overview of how data are collected on site and transmitted for processing and analysis is provided. It explains how data integrity is maintained during this process. A glossary of acronyms and drafting symbols found in the MPR is included. DOE

N81-18535# Lockheed Missiles and Space Co., Palo Alto, Calif.
AMORPHOUS THIN FILMS FOR SOLAR CELL APPLICATIONS Technical Progress Report, 15 Jul. - 10 Oct. 1980
A. D. Jonata, W. W. Anderson, J. L. Crowley, H. F. MacMillan, Jr., and J. A. Thorton 10 Oct. 1980 37 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-9237-1-T1; LMSC-D767125) Avail: NTIS HC A03/MF A01

A series of experiments performed to develop successful back-layer contacts for a MIS solar cell and to study the effects of argon inclusion on the properties of the active intrinsic layer in the a-Si:H cell are described. Mixtures of argon (AR), phosphine (Ph3), and hydrogen (H2) were used at various partial pressures to assess the effectiveness of doping with a reactive gas. The inclusion of argon in dc reactively-sputtered films was measured using specially prepared cathode image samples and the results correlated with the SiH2/SiH ratio in the films. Details are reported. DOE

N81-18536# Lockheed Missiles and Space Co., Palo Alto, Calif. Metallurgy and Composites Lab.
***ELECTRODE MATERIALS FOR COAL-FIRED MHD GENERATORS* Final Report, 1 Mar. 1977 - 31 May 1978**
R. A. Perkins Oct. 1980 163 p refs
(Contract EPRI Proj. 468-2)
(EPRI-AP-1562) Avail: NTIS HC A08/MF A01

Metallic materials are evaluated as electrodes for coal fired MHD generators. A laboratory test that simulates the electrochemical and corrosive environment was developed and used to characterize electrode behavior in a diffuse current flow (nonarcing) mode of operation. High current density requires that an electron transport mechanism of current flow be maintained. With inert, stable electrodes, anode polarization occurs and ionic conduction prevails, limiting current to low values. The nature of this

behavior and approaches to overcoming anodic polarization are studied as a functi- .f electrode material, slag composition, and temperature. By operating at high temperatures and with controlled slag chemistries to produce a very fluid slag, depolarization may be achieved by mechanical mixing. Interrupted current flow are required to aid in breaking down anodic polarization. DOE

N81-18537# New Mexico Inst. of Mining and Technology, Socorro. Dept. of Metallurgical and Materials Engineering.

MICROSTRUCTURAL AND MECHANICAL PROPERTY EVALUATION OF BLACK CHROME AND ZINC OXIDE COATED SOLAR COLLECTORS Annual Report, Jun. 1979 - Mar. 1980

O. T. Inal, L. E. Murr, and A. E. Torma 1980 85 p refs
(Contract DE-AS04-78AL-04266)
(DOE/AL-04266/T1; AR-2) Avail: NTIS HC A05/MF A01

Plating parameters for black chrome system were optimized with respect to selectivity utilizing simplex evolutionary operation procedures in sixteen sets of experiments. Overgrowths produced with the optimized parameters were evaluated for optical, structural, thermal stability and mechanical properties. It is observed that the coatings produced possess consistently high selectivity values, are durable against exposure to high temperature, are well attached to their structure, and are ductible. Black zinc oxide surfaces created on leaf zinc, electroplated zinc on steel, and hot-dip zinc coated steel substrates show selectivity values that vary between 6-9, are seen to maintain their physical integrity as well as optical properties. The plating parameters utilized in deposition of the coatings are seen to alter quantity and distribution of the elemental component and affect optical properties of these surfaces. DOE

N81-18538# Harvard Univ., Cambridge, Mass. Energy and Environmental Policy Center.

BOSTON SOLAR RETROFITS: STUDIES OF SOLAR ACCESS AND ECONOMICS

Michael Shapiro and Shauna Doyle Nov. 1980 101 p refs
(Contract DE-AT01-79CS-10047)
(DOE/CS-10047/T5) Avail: NTIS HC A06/MF A01

Studies of solar access and solar retrofit economics are described for residential applications in the City of Boston. The study of solar access was based upon a random sample of 94 buildings; the sample was stratified to ensure a broad geographic representation from the city's various sections. Using available data on the heights and orientations of the sampled structures and surrounding buildings, each building's hourly access to sunlight was computed separately for the roof and south facing walls. The second study was a comparative analysis of the economics of several solar heating and hot water systems. Next, a number of alternative approaches for solar space and water heating were identified from interviews with individuals and groups involved in solar retrofit projects in the Boston area. DOE

N81-18539# Argonne National Lab., Ill. Materials Science Div.

DEVELOPMENT OF NONDESTRUCTIVE EVALUATION TECHNIQUES FOR HIGH-TEMPERATURE CERAMIC HEAT EXCHANGER COMPONENTS Quarterly Report, Jul. - Sep. 1980

Oct. 1980 39 p refs
(Contract W-31-109-eng-38)
(ANL/MSD/FE-80-7; QR-12) Avail: NTIS HC A03/MF A01

Detection of electric discharge machined notches in a silicon carbide tube by an ultrasonic bore side probe under microcomputer control was demonstrated. Use of the reflection mode was shown to enhance the sensitivity of flaw detection with an acoustic microscope. In this configuration, the transducer and laser scanned coverslip are both on the tube outer surface, eliminating the need to fill the tube with water. A conceptual design is presented for inspecting tubes up to seven feet long in both through transmission and reflection mode configurations. A comparison of NDE techniques for ceramic butt joints showed holographic interferometry to be generally better than dye-penetrant, radiographic, or ultrasonic techniques for characterizing a crack-like inner wall defect. Pitch catch and pulse echo ultrasonic techniques also indicated the presence of an anomaly in the region identified as flawed via holography, while radiographic and penetrant testing results were ambiguous. DOE

N81-18540# Argonne National Lab., Ill. Components Technology Div.

SOME BASIC CONSIDERATIONS AND POSSIBLE IMPROVEMENTS ON THE SOLAR POND

W. T. Sha, Y. S. Cha, K. V. Liu, and S. L. Soo Jun. 1980 49 p refs
(Contract W-31-109-eng-38)
(ANL-CT-80-23) Avail: NTIS HC A03/MF A01

Experimental results were compared to theoretical stability criteria of a salt gradient solar pond. Cellular motion in the nonconvective layer is expected. Innovative concepts on friction stabilization using stabilizing barriers and longitudinal stratification to improve pond heat extraction efficiency are presented. DOE

N81-18541# Argonne National Lab., Ill. Chemical Engineering Div.

FAILURE ANALYSIS OF MARK 1A LITHIUM/IRON SULFIDE BATTERY

V. M. Kolba, J. E. Battles, J. D. Geller, and K. Gentry (Eagle-Picher Industries, Inc., Joplin, Mo.) Oct. 1980 119 p refs
(Contract W-31-109-eng-38)
(ANL-80-44) Avail: NTIS HC A06/MF A01

During startup heating prior to electrical testing, a short circuit developed in one of the modules, which resulted in a progressive failure of the cells. The other module, which was alongside and connected in series, was unaffected by the failure. The initial indication of difficulty was a small drop in the voltage of several cells, followed by short circuits in the balance of the cells and localized temperatures above 1000 C. A team consisting of ANL and Eagle-Picher personnel conducted a detailed failure analysis as the failed module was disassembled. The other module was also examined for purposes of comparison. The general conclusion was that the short circuit was initiated by electrolyte leakage and resulting corrosion in the nearby region which formed metallic bridges between cells and the cell ray, or arcing between cells and the cell tray through the butt joints in the electrical insulation. The above two mechanisms were also believed to be responsible for the failure propagation. DOE

N81-18542# Battelle Pacific Northwest Labs., Richland, Wash.

ASSESSMENT OF SOLAR OPTIONS FOR LARGE POWER APPLICATIONS

Walter J. Apley Oct. 1980 12 p refs Presented at the Solar Central Receiver Semi-Annual Meeting, San Francisco, 15 Oct. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8968; CONF-8010129-1) Avail: NTIS HC A02/MF A01

Comparative analyses of solar thermal conversion concepts were performed with the purpose of characterizing, evaluating, and ranking the principal solar thermal power concepts under consideration in the DOE-Solar Thermal Power Program, on the basis of an engineering and economic analysis of alternative power plant configurations. Conceptual designs developed for the selected systems were based on common assumptions of available technology in the 1990 to 2000 time frame. Designs best suited for a comparative evaluation of the concepts were formulated. Costs were estimated on the basis of identical assumptions, ground rules, methodologies, and unit costs of materials and labor applied uniformly to all of the concepts. Seven generic types of collectors, together with associated subsystems for electric power generation, were considered in the study. The collectors can be classified into three categories: two-axis tracking (with compound-curvature reflecting surfaces), one-axis tracking (with single-curvature reflecting surfaces), and nontracking (with low-concentration reflecting surfaces). DOE

N81-18543# Battelle Pacific Northwest Labs., Richland, Wash.

APPLICATION OF OPTICAL TRIANGULATION PROFILOMETRY AND OPTICAL PHASE RANGING PROFILOMETRY TO THE FIGURE EVALUATION OF SOLAR MIRRORS

J. W. Griffin and M. A. Lind Dec. 1980 43 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3615) Avail: NTIS HC A03/MF A01

The theoretical basis for each method is discussed and the results of initial feasibility experiments are reported. In OTP and OPRP the de-specularized mirror surface is probed with one or more visible laser beams. In OTP, two beams are required for the triangulation of coordinates on the mirror surface. In OPRP the second laser beam is retained within the instrument to form the reference leg of a long wavelength interferometer. Both methods are particularly adaptable to computer control for fast, automated analysis of mirror surfaces. In addition the proposed devices are compact and sturdy enough for easy implementation in field evaluation programs. The experimental resolution capability of the unoptimized OTP system is greater than or equal to 0.1 inch (2.54 mm). With further improvement of the beam projection and coincidence assessment systems, the design resolution goal of greater than or equal to 0.1 mm appears achievable. DOE

N81-18544# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

COMPARATIVE REPORT: PERFORMANCE OF ACTIVE SOLAR SPACE HEATING SYSTEMS, 1979-1980

P. W. Kendall, H. O. Holte, K. M. Welch, and M. J. Kennedy 1980 256 p refs

(Contract DE-AC01-79CS-30027)

(SOLAR/0025-80/42) Avail: NTIS HC A12/MF A01

Millions of individual mesurements from these sites provide a large reservoir of data for operational and comparative analysis. The detailed measurement data for these systems were analyzed and are presented on the basis of monthly and seasonal performance factors. The data points recorded by on site instruments are accumulated, reduced and analyzed in accordance with a hierarchal structure which leads to an understanding of overall system performance. Parameters and performance indices presented include overall system delivered loads, solar fraction of load, solar savings ratio, coefficient of performance, energy collected and stored, and various subsystem efficiencies. The comparison of these factors has allowed evaluation of the relative performance of various systems. A matrix of performance indices has been constructed to facilitate comparison of the representative solar heating installations. DOE

N81-18545# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.

THIN-FILM FLAT-PLATE SOLAR COLLECTORS FOR LOW COST MANUFACTURE AND INSTALLATION

John W. Andrews and William G. Wilhelm Mar. 1980 37 p refs

(BNL-51124) Avail: NTIS HC A03/MF A01

A solar energy collector design using thin film plastics in both the absorber and glazing is described. The design approach proceeded in two steps. First, cost constraints on solar collectors were determined using reasonable economic projections. Second, engineering was applied only to those ideas which had hope of falling within those cost boundaries. The use of thin film plastics appeared most attractive according to these criteria. The nature of the marketing and distribution network can be expected to have a strong impact on the final installed cost of the collector; the proposed design has characteristics which could make possible a reduced price markup. DOE

N81-18546# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.

TECHNICAL AND ECONOMIC FEASIBILITY OF A THERMAL GRADIENT UTILIZATION CYCLE (TGUC) POWER PLANT Final Report

Ashok M. Raiji, David A. Renfroe, and Thomas R. Lalk. 1980 115 p refs

(Contract DE-FG01-78CS-56604)

(DOE/CS-56604/T1) Avail: NTIS HC A06/MF A01

Power is generated by exploiting the natural atmospheric temperature gradient. A low grade energy source is used to vaporize a fluid which rises in a pipe to a higher elevation where it is condensed. The cycle is completed by passing the condensed liquid through a turbine as it returns to the lower elevation. A digital computer model was developed and used to simulate the operation of the cycle and to conduct a parameteric study. Life cycle cost analysis and energy analyses were conducted for the specific case of a TGUC using the ambient air at the lower elevation as an energy source. Although the cycle has a low thermal efficiency and is site specific, it is technically feasible. Variations in mass flow rate of the working fluid and elevation were found to affect the cycle power output to a large extent. The investment cost of a hypothetical 10 megawatt TGUC power plant was determined to be $3,080 per kilowatt, with life cycle busbar costs of electricity ranging from 47 to 55 Mills per kilowatt hour depending on the method of financing. DOE

N81-18547# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.

MANAGEMENT ASSISTANCE FOR THE DEVELOPMENT OF HYDROTHERMAL ENERGY IN THE ROCKY MOUNTAIN/BASIN AND RANGE REGION Final Report, 19 Oct. 1977 - 31 Dec. 1979

John R. Bowman, Ronald L. Bruhn, David S. Chapman, Kenneth L. Cook, Stanley H. Evans, Jr., Gerald W. Hohmann, William P. Nash, Gary R. Reynolds, William R. Sill, Robert B. Smith et al Sep. 1980 100 p refs

(Contracts DE-AC07-78ET-28392; EG-78-C-07-1701)

(DOE/ET-28392/T2) Avail: NTIS HC A05/MF A01

Abstracts of forty-six reports on this contract are presented. A comprehensive list of technical reports produced an geothermal resources sponsored by US DOE is included. DOE

N81-18548# California Univ., Livermore. Lawrence Livermore Lab.

EXPERIMENTAL AND NUMERICAL STUDY OF STEADY FORCED-CONVECTION HEAT TRANSFER IN A SPHERICAL ANNULUS Ph.D. Thesis

Dean B. Tuft 25 Nov. 1980 18 p refs

(Contract W-7405-eng-48)

(UCRL-53081) Avail: NTIS HC A02/MF A01

Measurements of inner sphere heat flux rate distribution, flow separation angle, annulus fluid temperatures and total heat transfer were made for gap Reynolds numbers from 41 to 1086. The angle of separation along the inner sphere was found to vary as a function of Reynolds number. Measured total Nusselt numbers agreed with results reported in the literature to within 2.0 percent at a gap Reynolds number of 974 and 26.0 percent at a gap Reynolds number of 66. Results of numerical calculations of laminar incompressible fluid flow and heat transfer in a spherical annulus are presented. Velocity, temperature, pressure and heat flux rate distributions are presented for gap Reynolds number from 4.4 to 440. The computations predict well the experimental trends and qualitative aspects of the flow and heat transfer while underpredicting heat flux rates by a factor of two or more. A turbulence model is necessary to predict more accurately the experimental results. DOE

N81-18549# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

THIN FILM ELECTROCHROMIC MATERIALS FOR ENERGY EFFICIENT WINDOWS

Carl M. Lampert Oct. 1980 47 p refs

(Contract W-7405-eng-48)

(LBL-10862; EEB-W-80-10) Avail: NTIS HC A03/MF A01

By use of electrochromic thin films, it is possible electronically to control transmission or reflection properties of a window, thus allowing it to be optically and thermally managed, thereby reducing space heating and cooling load. The properties of transition metal oxides, such as WO3, MoO3, Ir2O3, and V2O5 are detailed. Organic systems such as Heptyl Viologen, Polytungsten anion are reviewed. Also, intercalated structures are discussed. The designs of working devices are outlined. From this quantification, materials, devices, and appropriate deposition technology are selected for window applications. DOE

N81-18550# Sandia Labs., Albuquerque, N. Mex.

PROCEEDINGS OF THE VERTICAL AXIS WIND TURBINE (VAWT) DESIGN TECHNOLOGY SEMINAR FOR INDUSTRY

Sidney F. Johnston, ed. Aug. 1980 339 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-0984; CONF-8004128) Avail: NTIS HC A15/MF A01

The objective of the program is to develop technology that results in economical, industry produced, and commercially marketable wind energy systems. The purpose of the VAWT

Design Technology Seminar for Industry was to provide for the exchange of the current state of the art and predictions for future VAWT technology. Emphasis was placed on technology transfer on Sandia's technical developments and on defining the available analytic and design tools. DOE

N81-18551# Sandia Labs., Albuquerque, N. Mex. Experimental Systems Operations Div.

MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY PROGRAM FOR PREDICTING THERMAL PERFORMANCE OF LINE-FOCUSING, CONCENTRATING SOLAR COLLECTORS

Thomas D. Harrison Nov. 1980 29 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1964) Avail: NTIS HC A03/MF A01

The qualifications of the laboratories selected to do the testing and the procedure for selecting commercial collectors for testing are given. The testing program is outlined. The computer program for performance predictions is described. An error estimate for the predictions and a sample of outputs from the program are included. DOE

N81-18552# State Univ. of New York, Buffalo. Dept. of Electrical Engineering.

FABRICATION AND TESTING OF MIS SOLAR CELLS ON a-Si:F:H Final Report, 15 Sep. 1979 - 15 Sep. 1980

M. K. Han and Wayne A. Anderson 3 Nov. 1980 56 p refs Sponsored in part by Midwest Research Inst., Golden, Colo.
(Contract DE-AC02-77CH-00178)
(SERI/TR-8041-9-T1) Avail: NTIS HC A04/MF A01

Fabrication techniques and improved a-Si:H film processing were achieved to produce a short circuit current density of 7.5 mA sq/cm and open circuit voltage of 740 mV on large area a-Si cells by the deposition of an inexpensive semitransparent metal (Cr) as a top electrode on a N-I-P structure. This corresponds to a 2% efficiency using AMI illumination. A V(sub oc) of 830 mV and fill factor of 0.54 were also separately obtained. A relatively simple and inexpensive deposition technique using a one pumpdown vacuum system, Al grid, and thin metal film structure were applied to reduce the cost of a-Si:H cell fabrication. A SEM study of a-Si film quality shows the substrate texture to greatly influence the film morphology. This in turn serves to influence the uniformity of photovoltaic response on completed solar cells. The studies of optical transmittance of various thin metal films promote the utilization of Cr and Cu as a top electrode. Dark and illuminated I-V characteristics show that current conduction mechanisms and recombination phenomena are not the same under dark and illuminated conditions. DOE

N81-18553# Gilbert Associates, Inc., Reading, Pa.

RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL. VOLUME 1: BIOMASS ALLOCATION MODEL Technical Progress Report, period ending 30 Sep. 1980

Yong K. Ahn, Herbert T. Chen, Richard W. Helm, Eric T. Nelson, and Kevin J. Shields 1980 131 p refs
(Contracts DE-AC02-78ET-20611; ET-78-C-02-5022)
(DOE/ET-20611/14) Avail: NTIS HC A07/MF A01

A biomass allocation model was developed to show the most profitable combination of biomass feedstocks thermochemical conversion processes, and fuel products to serve the seasonal conditions in a regional market. This optimization model provides a tool for quickly calculating the most profitable biomass missions from a large number of potential biomass missions. Other components of the system serve as a convenient storage and retrieval mechanism for biomass marketing and thermochemical conversion processing data. The system can be accessed through the use of a computer terminal, or it could be adapted to a portable microprocessor. A User's Manual for the system is included. The validity of any biomass allocation solution provided by the allocation model is dependent on the accuracy of the data base. The initial data base was constructed from values obtained from the literature, and, consequently, as more current thermochemical conversion processing and manufacturing costs and efficiencies become available, the data base should be revised. DOE

N81-18554# Johnson Controls, Inc., Milwaukee, Wis.

COMMERCIALIZATION OF A THICK FILM SOLAR CELL Quarterly Technical Progress Report, 1 Sep. - 1 Oct. 1980

G. D. McDonald 1980 29 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/PR-8104-2-T3) Avail: NTIS HC A03/MF A01

Films of CdS were prepared by screen printing and were sintered using a variety of firing conditions and flux concentrations. At the higher temperatures, longer firing temperatures, and lower flux concentrations crystals of cadmium oxide formed on the surface of the CdS film. Preparation of the copper sulfide barrier via the aqueous solution treatment was found to produce suitable barriers only when the films were pre-etched in HCl and when the dip solution containing Cu2Cl2 was hot. The CdS films formed on indium oxide coated glass showed no evidence of indium penetration into the CdS layer. Transmission studies of the CdS layer failed because of the opacity of the films relative to the equipment available. DOE

N81-18555# Monosolar, Inc., Santa Monica, Calif.

EMERGING MATERIALS FOR SOLAR CELL APPLICATIONS: ELECTRODEPOSITED CdTe Quarterly Report, 16 May - 15 Aug. 1980

Robert L. Rod, Bulent Basol, and Oscar Stafsudd 10 Sep. 1980 15 p
(Contract DE-AC02-77CH-00178)
(SERI/PR-9152-1-T1; QR-2) HC A02/MF A01

Work was centered about improving electroplating processes and cell fabrication techniques, with emphasis being given to three differing n-CdTe/Au Schottky configurations. The highest values of efficiency related parameters achieved with a simulated solar irradiation of 100 mW/sq cm were 0.57V for open circuit voltage, 0.6 for fill factor, and 6 mA/sq cm for short circuit current. Four important parameters are known to control the quality of the Monosolar electrodeposition process and resultant solar cells. They are electrolyte temperature, Te concentration in the solution at a specific pH, deposition or quasi-rest potential, and flow pattern of the electrolyte (stirring). The first three considerations are believed to be fully understood and optimized. Work is underway to further understand the effects of stirring on the diffusion of ionic components and the effects on CdTe film performance. Work was accelerated during the quarter to increase the short circuit current. Parallel programs using laser irradiation of finished CdTe films, heat treatment, and changes in the electrodeposition process itself to recrystallize films were started. DOE

N81-18556# Motorola, Inc., Phoenix, Ariz. Solar Energy Research and Development Dept.

THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1980

K. R. Sarma, M. J. Rice, R. Legge, and R. J. Ellis Jun. 1980 49 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-8277-1-T1; QTPR-3) Avail: NTIS HC A03/MF A01

The high pressure plasma deposition process was thoroughly evaluated using SiHCl3 and SiCl4 silicon source gases, by the gas chromatographic analysis of the effluent gases from the reactor. Both the deposition efficiency and reactor throughput rate were found to be consistently higher for hpp mode of operation compared to conventional mode. The figure of merit for various chlorosilanes as a silicon source gas for hpp deposition is discussed. A new continuous silicon film deposition scheme is developed and system design is initiated. This new system employs gas interlocks and eliminates the need for gas curtains which are problematic. DOE

N81-18557# Poly Solar, Inc., Garland, Tex.

THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Technical Progress Report, 16 Jul. - 15 Oct. 1980

Oct. 1980 32 p
(Contract DE-AC02-77CH-00178)
(SERI/PR-9192-1-T2; TPR-2) Avail: NTIS HC A03/MF A01

The objectives of this contract are to fabricate large area thin film silicon solar cells with AM1 efficiency of 10% or greater with good reproducibility and good yield and to assess the feasibility of implementing this process for manufacturing solar

cells at a cost of $300/kWe. Efforts were directed to the purification of metallurgical silicon, the preparation and characterization of substrates and epitaxial silicon layers, and the fabrication and characterization of solar cells. The partial purification of metallurgical silicon by extraction with aqua regia was further investigated in detail, and the resulting silicon was analyzed by the atomic absorption technique. The unidirectional solidification of aqua regia extracted metallurgical silicon on graphite was used for the preparation of substrates, and the impurity distribution in the substrate was determined and compared with the impurity content in metallurgical silicon. The effects of heat treatment on the impurity distribution in the substrate and in the epitaxial layer were also investigated. DOE

N81-18558# Water and Power Resources Service, Denver, Colo. Engineering and Research Center.
SOLAR/HYDRO INTEGRATION STUDY Technical Progress Report, Feb. - Jul. 1980
1980 47 p refs
(Contract DE-AI03-79SF-10505)
(DOE/SF-10505/4) Avail: NTIS HC A03/MF A01

The Water and Power Resources Service in cooperation with the Department of Energy (DOE) is investigating the technical and economic feasibility of integrating solar central receiver powerplants with the Federal hydroelectric power system in the southwest United States. The principal hydro facility in this region is Hoover Dam. Typical meteorological year data were obtained for Las Vegas from the Solar Energy Research Institute. Plots of available solar energy at Yuma and Mormon Mesa are presented for several operational threshold levels. The data show that a solar plant's operational time can be reduced by 20% and still utilize more than 97% of the available solar energy. The Mormon Mesa site has slightly more solar energy available than the Yuma site. A meteorological surface observation network (MESONET) weather station is being prepared for installation at the Yuma site. The MESONET station which normally measures temperature, relative humidity, barometric pressure, wind speed, and wind direction will be retrofitted to measure direct beam and global radiation. The radiation data will be used in dynamic simulations of solar power systems. DOE

N81-18559# Westinghouse Research and Development Center, Pittsburgh, Pa.
DEVELOPMENT OF COPPER SULFIDE/CADMIUM SULFIDE THIN FILM SOLAR CELLS Technical Progress Report, 13 Jan. - 12 Apr. 1980
J. R. Szedon, F. A. Shirland, J. A. Stoll, H. C. Dickey, and W. J. Biter 23 Jul. 1980 39 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-8143-1-T2; TPR-3) Avail: NTIS HC A03/MF A01

During the course of this quarter, peak cell performance was improved from 0.455V to 0.510V, from 11.8 to 20.2 mA sq/cm, and from 3.3% to 6.5% as regards open circuit voltage, short circuit current density, and conversion efficiency, respectively. Information exchanges and critical reviews of process details were made with the cooperation of the group at the Institute of Energy Conversion, University of Delaware. As a result of these, two areas were identified which lead to higher cell performance. Substrate temperature control and monitoring during deposition were improved by the use of a thermocouple welded to the foil substrate. Fast, thorough rinsing of the CdS films in the interval between the etch for surface texturing and the immersion in cuprous chloride for barrier formation current and open circuit voltage performance. DOE

N81-18560# Texas A&M Univ., College Station. Dept. of Chemistry.
PHOTOCHEMICAL SOLAR ENERY CONVERSION IN SURFACTANT VEHICLES Annual Progress Report, 1 Mar. - 30 Nov. 1980
J. H. Fendler 1980 8 p refs
(Contract DE-AS05-80ER-10601)
(DOE/ER-10601/1) Avail: NTIS HC A02/MF A01

This report lists the personnel, journal publications, oral presentations, and summarizes the scientific activities: the neodymium-yag laser system was installed; based on this laser, a nonosecond flash photolysis system was constructed; water soluble 5,10,15,20-tetra-p-n-methyl-pyridinochloride zinc-porphyrin were synthetized, purified and characterized; and photosensitized electron transfer, charge separation a hydrogen production were demonstrated in surfactant. DOE

N81-18561# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE CdSiAs2 THIN FILMS FOR SOLAR CELL APPLICATIONS Final Report, 9 Apr. 1979 - 8 Mar. 1980
L. C. Burton and L. H. Slack Jun. 1980 71 p refs
(Contract DE-AC04-79ET-23007)
(DOE/ET-23007/4) Avail: NTIS HC A04/MF A01

Compounds of Cd-Si-As2 required for sputtering targets and evaporation charges were synthesized by direct fusion. These include CdSiAs2, Cd3As2, CdAs2 and SiAs. Polycrystalline ingots of CdSiAs2 were found to be porous, with the chalcopyrite structure, and with minor amounts of other phases such as CdAs2, SiAs,As and Cd3As2. Sputtered films were formed in a single target RF system. A homogeneous CdSiAs2 target was initially used, followed by composite targets consisting of CdAs2 + Si. Films from the latter targets were superior to the others and were more extensively studied. As deposited films were amorphous, off stoichiometry, with resistivities over 10 to the 8th power cm and band gaps of approx. 1.4 eV. Subsequent reactive heat treatments in the 515 to 615 C range resulted in crystalline films, resistivities of 1 to 10 cm, CdSiAs2 compositions within 15 of stoichiometry, energy gap of approx. 1.55 eV, absorption coefficient of .0002/ cm at 0.6 micrometers, but with poor mechanical properties (mainly cracking). A Ta/SiO2 substrate proved to be the best for these films. DOE

N81-18562# Foster-Miller Associates, Inc., Waltham, Mass.
DESIGN AND DEVELOPMENT OF STIRLING ENGINES FOR STATIONARY POWER GENERATION APPLICATIONS IN THE 500 TO 3000 HORSEPOWER RANGE Quarterly Report
Feb. 1980 61 p refs
(Contracts DE-AC02-79ET-15208; W-31-109-eng-38)
(DOE/ET-15208/1; QR-1) Avail: NTIS HC A04/MF A01

Initial work on the design and development of Stirling engines for stationary integrated energy systems is reported. Information is included on a market assessment, design methodology, evaluation of engine thermodynamic performance, and preliminary system design. It is concluded that Stirling engines employing clean fossil fuels cannot compete with diesel engines. However, combustion technology exists for the successful burning of coal derived fuels in a large stationary Stirling engine. High efficiency is predicted for such an engine and further development work is recommended. DOE

N81-18563# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Nuclear and Alternative Energy Systems.
ENERGY CHOICES IN A DEMOCRATIC SOCIETY
Laura Nader Apr. 1980 156 p refs
(PB81-114852; ISBN-0-309-03045-5; LC-80-81335) Avail: NTIS HC A08/MF A01 CSCL 10A

Four views of the future involving widely varying levels of energy consumption and life styles are presented. The futurists' descriptions of life in the imagined societies, loosely termed superindustrial, plentitude, small is beautiful, and minimum feasible are explored according to predictions about twelve cultural dimensions, including natural environment, settlement patterns, occupations, leisure, dispersion of decision making power, and pluralism vs. homogeneity. These descriptions demonstrate some possible results of alternatives to be considered by scientists, policymakers, and citizens concerned about the direction of energy policy. GRA

N81-18564 Stanford Univ., Calif.
SILICON SOLAR CELL DESIGN FOR MEDIUM CONCENTRATION APPLICATIONS Ph.D. Thesis
Frederick Chien-Ming Wu 1980 127 p
Avail: Univ. Microfilms Order No. 8103577

Two solar cell processes were developed leading to solar cells that are fabricated directly on an existing commercial integrated circuits processing line. The computer model developed used a simple but realistic equivalent circuit approach. Through simulation of variations arising from carrier lifetime, resistance

and surface effects, the program shows that for typical values obtained from a commercial line, a surface junction structure, where a p-n junction is formed over the entire top surface of the cell, gives maximum energy conversion efficiencies for 1 to 200 times solar concentrations. Two different surface junction solar cells were designed to maximize current collection. Laser annealing cannot be substituted as an ion-implantation damage annealing step. The remaining point defects are enough to cause a degradation of cell performance, and a subsequent thermal anneal is necessary to restore the expected efficiency.
Dissert. Abstr.

N81-18565 Colorado Univ. at Boulder.
AERODYNAMIC ANALYSIS OF PROPELLER-TYPE WINDMILLS WITH HELICAL TRAILING VORTICES Ph.D. Thesis
Ta-Ching Shiao 1980 75 p
Avail: Univ. Microfilms Order No. 8103137

To improve the strip theory for computing the performance of a propeller type windmill, a realistic analysis is formulated to include the wake effect. The finite-wing theory is applied to a rotor blade to find its circulation distribution with the downwash determined from a direct integration of Biot-Savart's law based on the entire helical trailing vortex system. An iterative procedure was developed to determine the sectional properties at some selected stations. A computer program is constructed for the computation, in which the empirical lift and drag data of the blade airfoil section are programmed. The torque, thrust and power output of the windmill are obtained by integrating the sectional aerodynamic properties from hub to tip along the blades. Two windmills, one with twisted and tapered blades and the other with uniform blades, are used as examples in predicting the performances. Dissert. Abstr.

N81-18566 Connecticut Univ., Storrs.
THERMAL PERFORMANCE PREDICTIONS OF FLAT-PLATE SOLAR COLLECTOR AIR HEATERS Ph.D. Thesis
Thomas Charles ONeill 1980 250 p
Avail: Univ. Microfilms Order No. 8103219

A computer program was written that models heat exchanges occurring within flat plate solar air collectors and which computes the incoming solar flux and heat losses to the environment. Internal collector temperatures and thermal efficiencies are predicted for either steady state or transient cases from finite difference solutions to a set of energy balance equations. These relations are written for thermal modes that are generated and linked together by the internal deck logic. The program was utilized in a study of three types of air collectors. The first two configurations employed crossflow impingement along the backside of their absorbers to augment heat transfer coefficients developed at those surfaces, while the third used a rock matrix absorber to expand its surface area for heat transfer. In addition, the first collector replaced the conventional stationary plate absorber of the second design by a traveling belt. Dissert. Abstr.

N81-18991*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SENSITIVITY MODEL FOR ENERGY CONSUMPTION IN BUILDINGS. PART 1: EFFECT OF EXTERIOR ENVIRONMENT
F. L. Lansing *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 58-88 refs (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 10A

N81-18998*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FUEL CELLS FEASIBILITY
D. Schonfeld and T. Charng *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 154-168 refs (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 10A

N81-18247# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CLOSED-CYCLE HELIUM GAS TURBINE FOR SOLAR TOWER POWER PLANT
Pierre Duran *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-652) 1980 p 35-50 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 109-122 Original report in FRENCH previously announced as A80-46228 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-18567 California Univ., Los Angeles.
THE EFFECT OF SAN FRANCISCO'S WASTEWATER PLAN ON WATER QUALITY AND AQUATIC BIOLOGY Ph.D. Thesis
Carolyn Thomas Hunsaker 1980 207 p
Avail: Univ. Microfilms Order No. 8102840

A historical overview of San Francisco's aquatic resources, fishing industry, and water quality is presented. Three studies quantifying beneficial uses (shellfishing, fishing, swimming, sightseeing, etc.) along the shoreline and the public health risk associated with these uses are discussed. The water quality and aquatic ecology section of the EIR on the Southwest WPCP is also reviewed. The ocean discharge with eight average annual discharges was chosen as the 'apparent best alternative' by the city and its project engineers. The environmental review process for the San Francisco Wastewater Master Plan is discussed in reference to water quality and aquatic biology. It appears the environmental review discussed had little influence on the San Francisco wastewater planning and design decisions that will affect water quality and aquatic biology. These decisions seemed to be mostly influenced by politics and changing regulations.
Dissert. Abstr.

N81-18568 Alabama Univ. in Huntsville.
FLUID MECHANICS NUMERICAL COMPUTATION WITH APPLICATION IN SIMULATION OF THE LIFE CYCLE OF WARM ADVECTION FOG Ph.D. Thesis
Goang-Shin Liaw 1980 192 p
Avail: Univ. Microfilms Order No. 8103979

A large amount of pollutants in highly industrialized areas is produced by a photochemical reaction of NOx and SOx, which result from energy related fuel combustion. These pollutants provide the major source of condensation nuclei for the formation of fog in the areas of busy highways, airports, seaports, etc. The present study stimulates numerically how these pollutants affect the formation of advection fog. Both microphysical and macrophysical processes are considered in investigating the time dependent evolution of the spectra of condensation nuclei associated with both polluted and clean atmospheres during the time period of advection fog formation. In this study, the process of advection fog formation has been examined based on the initial aerosol population using a monodisperse, single component model; a monodisperse, multicomponent model; a nonmonodisperse, single component model; and a nonmonodisperse, multicomponent model. The results of the numerical simulations show that for a condensation nucleus to grow into a droplet, the air must have attained a certain degree of supersaturation.
Dissert. Abstr.

N81-18569*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
IECM CALIBRATION AND DATA REDUCTION REQUIREMENTS
Fred D. Wills and Charles W. Davis Jan. 1981 52 p (NASA-TM-82400) Avail: NTIS HC A04/MF A01 CSCL 13B

The induced environment contamination monitor (IECM) tape recorder format, as it relates to the ouput of meaningful data from the IECM instrument, is explained. Eight-bit words (or bytes) generate numbers that represent voltage levels of electronic detection probes for each experiment. This information is amalgamated by the IECM Data Acquisition and Control System (DACS). In some cases bits represent certain status situations concerning an experiment, such as whether a valve is opened or closed. Voltages are transformed into meaningful physical

phenomena through equations of calibration. Data formats and plots are generated as requested for each IECM experimenter. T.M.

N81-18570*# National Aeronautics and Space Administration, Washington, D. C.

DISTURBANCE TO THE POPULATION DUE TO FLIGHT OPERATIONS AT LANDING FIELDS

Bernd Rohrmann Feb. 1981 118 p refs Transl. into ENGLISH of "Die Gestoertheit des Bevolkerung Durch den Flugbetrieb auf Landeplaitzen" Hamburg, Jul. 1975 108 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76531) Avail: NTIS HC A06/MF A01 CSCL 13B

By means of a social-psychological field study, an explanation for the extent of annoyance and disturbance resulting from flight operations of non-commercial aircraft was found, including moderating, nonphysical factors. Residents near four landing fields between the ages of 19-70 were selected in predetermined clusters. From the sample drawn, 398 interviews were conducted. Informal conversations were also carried out with certain influential persons and acoustical measurements were made at 5 points in Braunschweig. The data was processed and evaluated at the computer center in Hamburg. The study includes an extensive discussion of the results gained from the questionnaire and subjected to statistical analysis. T.M.

N81-18571*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE ENVIORNMENTAL ASSESSMENT OF A CONTEMPORARY COAL MINING SYSTEM

Elisabeth J. Dutzi, Patrick J. Sullivan, Charles F. Hutchinson, and Christopher M. Stevens 15 Dec. 1980 55 p refs

(Contracts NAS7-100; DE-AI01-76ET-12548)

(NASA-CR-163974; JPL-Pub-80-99) Avail: NTIS HC A04/MF A01 CSCL 13B

A contemporary underground coal mine in eastern Kentucky was assessed in order to determine potential off-site and on-site environmental impacts associated with the mining system in the given environmental setting. A 4 section, continuous room and pillor mine plan was developed for an appropriate site in eastern Kentucky. Potential environmental impacts were identified, and mitigation costs determined. The major potential environmental impacts were determined to be: acid water drainage from the mine and refuse site, uneven subsidence of the surface as a result of mining activity, and alteration of ground water aquifers in the subsidence zone. In the specific case examined, the costs of environmental impact mitigation to levels prescribed by regulations would not exceed $1/ton of coal mined, and post mining land values would not be affected. T.M.

N81-18572# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

EVALUATION OF THE NOISE IMPACT OF SATELLITE POWER SYSTEM VEHICLES ON THE COMMUNITY AND ECOLOGY AT THE LAUNCH SITE

Karl S. Pearson, Pritchard H. White, and John F. Wilby Dec. 1980 109 p refs

(Contract W-7405-eng-48)

(LBL-11978; BBN-4210) Avail: NTIS HC A06/MF A01

Placement of the Satellite Power System (SPS) satellites into orbit will require the launch of many heavy space vehicles over a 30 year period. These vehicles will generate rocket noise at launch and sonic booms at launch and on return to the landing site. In this study, rocket noise levels and sonic boom pressures are predicted for the region around a typical launch/landing site. The response of humans and animals to broadband and impulsive noise is reviewed briefly and the appropriate information is applied to the specific noise levels and sonic boom pressures predicted for the region around the launch/landing site. It is estimated that noise levels will be high enough that hearing protection will be required for personnel at the launch site and that there will be significant annoyance (more than 5% highly annoyed) to the population within 9 km from the launch site. Infrasound (sub-audio frequencies) will probably cause significant annoyance over a larger region. With launches over the ocean, the very high sonic boom pressures during ascent will occur over unpopulated areas. However, booms generated during descent of the orbiters will occur over populated areas and it is predicted that there will be significant annoyance at distances up to 45 km from the launch/landing site. DOE

N81-18573# PEDCo-Environmental, Inc., Cincinnati, Ohio.

ACID RAIN: THE IMPACT OF LOCAL SOURCES

P. Spaite (Paul W. Spaite Co.), M. P. Esposito, M. F. Szabo, and T. W. Devitt 24 Nov. 1980 28 p refs

(Contract DE-AC21-80MC-14787)

(DOE/METC-14787/103) Avail: NTIS HC A03/MF A01

Acid rain is predominantly a problem of long range transport of pollutants from large fossil fuel combustion sources, namely coal-fired utilities. However, close examination of fuel use information and source emission characteristics in the Adirondacks, Florida, and California suggests that local oil burning and automotive sources may be major contributors to the occurrence of acid rain in these areas. The possible role of local combustion sources in the production of acid rain, the implications of the findings, and their relevance to alternative control strategies for acid rain are discussed. Oil-fired boilers, especially the smaller commercial, industrial, and residential units, produce at least 3 to 10 times as much primary sulfate per unit of sulfur content as coal-fired units. Oil-fired units emit comparatively large quantities of catalytic compounds capable of rapidly converting still more sulfur oxide to sulfate in the atmosphere. DOE

N81-18574# Iowa Univ., Iowa City. Engineering Research Inst.

WATER-RELATED ENVIRONMENTAL CONTROL REQUIREMENTS AT MUNICIPAL SOLID WASTE TO ENERGY CONVERSION FACILITIES

James C. Young and Lyle D. Johnson Sep. 1980 205 p refs

(Contract W-7405-eng-82)

(DOE/EV-0116) Avail: NTIS HC A10/MF A01

Water use and waste production, water pollution control technology requirements, and water related limitations to their design and commercialization are identified at municipal solid waste to energy conversion systems. Findings relative to water management and waste water treatment of each of four municipal solid waste to energy conversion categories were investigated. These include: mass burning, with direct production of steam for use as a supplemental energy source; mechanical processing to produce a refuse derived fuel for cofiring in gas, coal or oil fired power plants; pyrolysis for production of a burnable oil or gas; and biological conversion of organic wastes to methane. A brief description of each waste to energy facility visited during the subject survey shows points of water use and wastewater production. One or more facilities of each type were selected for sampling of waste waters and follow up tests to determine rquirements for water related environmental controls. DOE

N81-18575# California Univ., Livermore. Lawrence Livermore Lab. Environmental Sciences Div.

ENVIRONMENT, HEALTH, SOCIOECONOMIC AND ENVIRONMENTAL CONTROL TECHNOLOGY EXECUTIVE SUMMARY

David W. Layton Oct. 1980 38 p refs

(Contract W-7405-eng-48)

(DOE/TIC-11308) Avail: NTIS HC A03/MF A01

The important findings of a two volume report that deals with the potential impacts and environmental controls associated with the operation of geothermal power plants in California's Imperial Valley are summarized. The valley contains nearly a third of the nation's total energy potential for identified hot water resources. Possible impacts of developing those resources include violation of air quality standards if emissions of hydrogen sulfide are not abated, negative ecological effects resulting from increases in the salinity of the Salton Sea, and damage to irrigation systems caused by land subsidence induced by the extraction of geothermal fluids. Other minor impacts concern occupational health and safety, socioeconomics, and hazardous wastes. Analyses of environmental impacts and the control measures for minimizing negative impacts are based primarily on a projected production of 3000 MW of electrical power by the year 2010. DOE

N81-18576# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.

MICROENVIRONMENTAL CHANGES AND PLANT RESPONSES DUE TO SHADING AND WIND DEFLECTION BY SOLAR COLLECTORS: A SIMULATION STUDY
Duncan T. Patten and S. D. Smith Nov. 1980 71 p refs
(Contract DE-AC03-76SF-00012)
(UCLA-12/1268) Avail: NTIS HC A04/MF A01

The potential changes were investigated in a Sonoran Desert. The simulated array consisted of twelve panels designed to exhibit a similar shape, tilt, and spacing as is expected to occur in heliostat fields of solar thermal facilities or in arrays of photovoltaic collectors. The experimental design was based on comparing two microsites in the simulated array versus the open desert. Presence of the panels results in up to a 90% reduction in solar radiance during the midday period, with microsites beneath each panel receiving about 14% of the open desert irradiance over the whole day. The array of panels also effected a 14% to 60% reduction in monthly accumulated wind flow in the center of the array. The combination of reduced radiant energy input and wind deflection resulted in significantly reduced surface and soil temperatures in the heavily shaded sites, and moderately reduced surface and soil temperatures in the sunny microsites. DOE

N81-18577# Oak Ridge National Lab., Tenn.
A COMPARISON OF ENVIRONMENTAL ISSUES RELATED TO DEVELOPMENT OF SMALL HYDROPOWER RESOURCES AT NEW VERSUS EXISTING SITES
J. M. Loar and S. G. Hildebrand 1980 20 p refs Presented at 3rd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 15 Dec. 1980
(Contract W-7405-eng-26)
(CONF-801210-13) Avail: NTIS HC A02/MF A01

Many of the ecological issues associated with the development of small hydropower resources are similar at both new (undeveloped) sites and those with existing dams that will be retrofitted for hydroelectric generation. Issues that could occur with both types of development are: blockage of fish migration routes; water level fluctuations; instream flows, water quality; dredging and dredged material disposal; and threatened or endangered species. However, new site development projects require the alteration of existing aquatic and terrestrial ecosystems that will be, in most cases, significantly greater than the environmental changes associated with the retrofitting of existing dams. Although project design and operation are important factors controlling the nature and magnitude of the environmental impacts of small hydropower resource development, the mitigation of adverse impacts (and the optimization of beneficial effects) is dependent, in large measure, on our ability to accuratly predict physical, chemical, and biological changes. DOE

N81-18578# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
STRATEGIES FOR ECOLOGICAL EFFECTS ASSESSMENT AT DOE ENERGY ACTIVITY SITES
F. S. Sanders, S. M. Adams, L. W. Barnhouse, J. M. Giddings, E. E. Huber, K. D. Kumar, D. Lee, B. Murphy, G. W. Suter, and W. VanWinkle Dec. 1980 389 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6783) Avail: NTIS HC A17/MF A01

Guidance for the monitoring and assessment of ecological impacts resulting from DOE energy production activities was developed to improve the accuracy of analysis under the National Environmental Policy Act. Basic concepts in monitoring and assessment that can be adapted to site specific circumstances are stressed. Four major areas of activity that should be integrated into a comprehensive interdisciplinary assessment program are: field monitoring; laboratory studies; experimental field perturbation studies; and mathematical modeling, both statistical and ecological. Each of these areas is discussed with respect to terrestrial, marine, and freshwater environments. Appendices are included that provide references to sampling methodologies. DOE

N81-18579# National Academy of Sciences - National Research Council, Washington, D. C.
CONTROLLING AIRBORNE PARTICLES
Apr. 1980 136 p refs
(Contract EPA-68-02-2890)
(PB81-114969; ISBN-0-309-03035-8; LC-80-13769) Avail: NTIS HC A07/MF A01 CSCL 13B

Ambient concentrations of particles in the air, their sources, and techniques for their control are discussed. The availability of technology for protecting the population from potentially harmful exposures is assessed. The contents are: introduction; ambient particles and their measurement; sources of atmospheric particles; control measure; relationships between emissions and air quality. GRA

N81-18580# National Academy of Sciences - National Research Council, Washington, D. C.
LONG-RANGE ENVIRONMENTAL OUTLOOK
May 1980 210 p refs Workshop held at Washington, D.C., 15-16 Nov. 1979
(PB81-114977; ISBN-0-309-03038-2; LC-80-16190) Avail: NTIS HC A10/MF A01 CSCL 13B

Proceedings of a workshop to address a long range environmental outlook are reported. Task groups were established to discuss future trends in energy, agriculture, toxic substances, and hazards of facility siting and the potential environmental problems that may develop. The charge to each group was to identify specific future problems, establish the priority of importance and recommend research. GRA

N81-18581# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
AMMONIUM SULFATE MANUFACTURE: BACKGROUND INFORMATION FOR PROMULGATED EMISSION STANDARDS Final Report
Oct. 1980 22 p refs
(Contract EPA-68-02-3061)
(PB81-118747; EPA-450/3-79-034B) Avail: NTIS HC A02/MF A01 CSCL 13B

Standards of performance for the control of emissions from ammonium sulfate manufacture plants in the U.S. are discussed. The standards apply to new, modified, or reconstructed facilities at caprolactam by produce, synthetic and coke oven by product ammonium sulfate manufacturing plants. GRA

N81-18003*# Federal Aviation Administration, Washington, D.C. Office of Environment and Energy.
ENVIRONMENTAL EFFECTS OF AN AIRCRAFT AT CRUISE: AN UPDATE
N. Sundararaman *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 519-534 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 13B

N81-18004*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED TECHNOLOGY FOR CONTROLLING POLLUTANT EMISSIONS FROM SUPERSONIC CRUISE AIRCRAFT
Robert A. Duerr and Larry A. Diehl *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 535-549 (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 13B

N81-18254# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A PREDICTION MODEL FOR ATMOSPHERIC POLLUTION CAUSED BY A POLLUTANT SOURCE
Anne-Marie Bouchardy *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-3 (ESA-TT-657) 1980 p 27-33 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-3, May - Jun. 1980 p 169-175 Original report in FRENCH previously announced as A80-43546 (For primary document see N81-18251 09-31)
Avail: NTIS HC A05/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-18582 Colorado Univ. at Boulder.
QUATERNARY STRATIGRAPHY AND PALYNOLOGY OF THE CLYDE FORELAND, BAFFIN ISLAND, N.W.T., CANADA Ph.D. Thesis
William Niles Mode 1980 233 p
Avail: Univ. Microfilms Order No. 8103121

Surficial glacial and marine landforms and subsurface glaciomarine deposits in the Clyde area of eastern Baffin Island were correlated. Prominent moraines and an associated series of shorelines on the foreland correlate with Kogalu aminozone glaciomarine sediments of the coastal cliff exposures. Kogalu glacier ice had retreated from the foreland more than 39,000 years BP, and the overlying aminozone, the Eglinton, is of Holocene age and the only aminozone not of glaciomarine origin. No glacial tills are exposed in the coastal cliffs and this suggests that relative sea level was high each time ice reached the foreland. Pollen analysis suggests that (1) glaciations of the foreland occurred when the surface water of the western Baffin Bay was warmer than it is today while terrestrial temperatures at Clyde were comparable to today's and (2) the 7000 year record reflects a fourfold sequence of climate change beginning with a climatic optimum followed by cooling, a secondary warming, and finally cooling to present. Dissert. Abstr.

N81-18583 Colorado Univ. at Boulder.
A STUDY OF FROZEN FLUX FLUID MOTIONS AT THE SURFACE OF EARTH'S LIQUID CORE AS DEDUCED FROM MAGNETIC OBSERVATIONS AT EARTH'S SURFACE Ph.D. Thesis
Lorant Andreas Muth 1980 131 p
Avail: Univ. Microfilms Order No. 8103123

A theoretical expression for a horizontal frozen flux fluid motion at the surface of Earth's liquid core is derived for a zeroth order Earth model. Each horizontal velocity component is determined by the ratio of a horizontal component of electric field to the vertical magnetic field. The required fields are obtained by extrapolating the surface values through a current free mantle using potential theory. Maps of the resulting surface velocity field are constructed numerically from high quality magnetic main field and secular variation models for epoch 1965.0. It is found that these models predict unbounded motion at places where the vertical magnetic field vanishes, and, hence, are unrealistic within the framework of the zeroth order Earth model. A mutual consistency criterion between the secular variation model and main field model that guarantees boundedness of the velocity field everywhere is then developed. An iterative least squares procedure is introduced to determine secular variation models that satisfy this criterion and a specific model is obtained under the further assumption that the top portion of the core is highly stratified. Dissert. Abstr.

N81-18584 California Inst. of Tech., Pasadena.
LARGE IMPACT CRATERS AND BASINS: MECHANICS OF SYNGENETIC AND POSTGENETIC MODIFICATION Ph.D. Thesis
William Beall McKinnon 1981 240 p
Avail: Univ. Microfilms Order No. 8104671

The impact crater is the ubiquitous landform of the solar system. Theoretical mechanical analyses are applied to the modification stage of crater formation, both syngenetic (immediate or short term) and postgenetic (long term). The mechanical stability of an impact crater is analyzed via a quasistatic, axisymmetric slip line theory of plasticity. The yield model incorporated at Mohr-Coulomb and a simplified rectangular profile is used for the transient cavity. Shortly after the excavation of a large impact crater the transient cavity collapses, driven by gravity. It is shown that at least one concentric fault scrap forms about the crater, if the strength of the target material decreases sufficiently rapidly with increasing depth. This is demonstrated by two classes of models; extrusion flow models which assume a weak layer underlying a strong layer and plastic flow models which assume a continuous decrease of cohesion strength with depth. Both classes predict that the ratio of the radius of the scarp to the transient crater radius is between 1.2 and 2 for large craters. Dissert. Abstr.

N81-18585 Rensselaer Polytechnic Inst., Troy, N. Y.
RELIABILITY OF GEOTECHNICAL SYSTEMS Ph.D. Thesis
Kingsley Ormonde Harrop-Williams 1980 281 p
Avail: Univ. Microfilms Order No. 8103766

The main objectives are: to examine the interdependence of the failure modes of some common geotechnical structures (i.e., soil slopes, earth retaining structures and shallow foundations); to provide a probabilistic description to the problem of interference of two near by sited structures; and to assess the reliability of one or more geotechnical structures having inter-dependent modes of failure. The above objectives were achieved within the framework of probability theory and reliability analysis. The measure of safety that was employed throughout the study was the probability of failure defined as the probability with which the resistance (R) of structure along a given mode of failure is exceeded by the applied loading (S). The effect of the correlation of R and S on the probability of failure was investigated. Soil strength parameters c and phi were introduced as correlated random variables and a probabilistic model was developed for the description of their joint distribution. Dissert Abstr.

N81-18586 Purdue Univ., Lafayette, Ind.
GEOTECHNICAL DATA BANK FOR INDIANA Ph.D. Thesis
Yung-Kwong Terence Lo 1980 574 p
Avail: Univ. Microfilms Order No. 8102681

Efforts to extract the geotechnical information contained in the subsurface investigation reports held in the files of the Indiana State Highway Commission extended over several years. A total of 9442 sets of data have been stored through early 1978 to mid 1979. The data were grouped by using physiographic region or engineering soil classification, or soil association, or a combination of them. One-way classification, two-way classification, and factorial experiment layouts were used to examine the distributions of the data. Regression analysis was used to investigate the functional relationships between design parameters and index properties. Topographic features were found to be significantly different among physiographic regions. Remolded soil characteristics were also evaluated and contrasted between physiographic regions. Statistical soil profiles were developed showing the relations of soil characteristics versus depth for soil association within a physiographic region. Finally, soil design parameters were estimated by using index properties. Dissert. Abstr.

N81-18587*# Ocean Data Systems, Inc., Monterey, Calif.
ADVANCED DEVELOPMENT OF ATMOSPHERIC MODELS
Philip G. Kesel, Rodger A. Langland, Pamela L. Stephens, Robert E. Welleck, and Paul M. Wolff Jun. 1979 186 p refs
(Contract NAS5-24468)
(NASA-CR-166630) Avail: NTIS HC A09/MF A01 CSCL 04A

A set of atmospheric analysis and prediction models was developed in support of the SEASAT Program existing objective analysis models which utilize a 125x125 polar stereographic grid of the Northern Hemisphere, which were modified in order to incorporate and assess the impact of (real or simulated) satellite data in the analysis of a two-day meteorological scenario in January 1979. Program/procedural changes included: (1) a provision to utilize winds in the sea level pressure and multi-level height analyses (1000-100 MBS); (2) the capability to perform a pre-analysis at two control levels (1000 MBS and 250 MBS); (3) a greater degree of wind- and mass-field coupling, especially at these controls levels; (4) an improved facility to bogus the analyses based on results of the preanalysis; and (5) a provision to utilize (SIRS) satellite thickness values and cloud motion vectors in the multi-level height analysis. A.R.H.

N81-18588*# California Univ., San Diego, La Jolla.
THE AURORAL PARTICLES EXPERIMENT Final Technical Report
[1981] 26 p

(Contract NAS5-21055)
(NASA-CR-166632) Avail: NTIS HC A03/MF A01 CSCL 04A

An instrument for the detection of particles in the energy range of 0.1 eV to 80 keV was designed, built, tested, calibrated, and flown onboard the spacecraft ATS-6. Data from this instrument generated the following research: intensive studies of the plasma in the vicinity of the spacecraft; global variations of plasmas; correlative studies using either other spacecraft or ground based measurements; and studies of spacecraft interactions with ambient plasmas including charging, local electric fields due to differential charging, and active control of spacecraft potential. Results from this research are presented. T.M.

N81-18589# Electronics Research Lab., Adelaide (Australia).
THE MEASUREMENT AND SIMULATION OF THE LIGHT OF THE NIGHT SKY
M. S. Brown Jan. 1981 25 p refs
(ERL-0180-TM; AR-002-090) Avail: NTIS HC A02/MF A01

A description is given of the spectral distribution and origins of the light of the night sky. Details are provided of the design of a filter for use with a tungsten filament light source to produce a spectral distribution similar to that of the moonless night sky. The level of illumination from the filtered light source was set by reference to radiometer measurements of the night sky made at a remote coastal location. Author

N81-18590*# Ohio State Univ., Columbus. ElectroScience Lab.
A SPECTRUM OF OZONE FROM 760 TO 5800 cm-1 Interim Technical Report
E. Damon, R. L. Hawkins, and J. H. Shaw Feb. 1981 622 p refs
(Grant NsG-7479; OSURF Proj. 761420; OSURF Proj. 711626)
(NASA-CR-164006) Avail: NTIS HC A99/MF A01 CSCL 04A

An atlas of O3 lines between 760 and 5800/cm obtained from a low pressure, long-path-length sample of O3 at 296 K is presented. Many of the line centers are marked and their positions tabulated. Author

N81-18591*# National Aeronautics and Space Administration, Washington, D. C.
METHOD OF DETERMINATION OF THE MASS COMPOSITION OF RING CURRENT IONS
V. V. Temnyy, Yu. V. Gott, and Yu. I. Usikov Aug. 1980 18 p refs Transl. into ENGLISH of "Metod opredeleniya massovogo sostava ionov koltsevogo toka" Rept. Pr-414 Moscow, 1978 16 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-76246) Avail: NTIS HC A02/MF A01 CSCL 04A

A method for individual registration of protons, and helium and oxygen ions, with energies E for a charge on the order of 100 keV/q in the ring currents of the Earth's magnetosphere was examined. The method is based on the various specific losses in energy by these ions in matter. The ion current, selected according to E/q, is passed through a solid target, after which identification of the masses is carried out, based on the energy losses in the possibly to reliably divide the flows of protons, and helium and oxygen ions. T.M.

N81-18592*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHEMICAL KINETIC AND PHOTOCHEMICAL DATA FOR USE IN STRATOSPHERIC MODELING EVALUATION NUMBER 4: NASA PANEL FOR DATA EVALUATION
15 Jan. 1981 131 p refs
(Contract NAS7-100)
(NASA-CR-163973; JPL-PUB-81-3) Avail: NTIS HC A07/MF A01 CSCL 04A

Evaluated sets of rate constants and photochemical cross sections compiled by the Panel are presented. The primary application of the data is in the modelling of stratospheric processes, with particular emphasis on the ozone layer and its possible perturbation by anthropogenic and natural phenomena. T.M.

N81-18593# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
BEHAVIOR OF HIGH-LATITUDE IRREGULARITIES DURING GEOMAGNETIC DISTURBANCES
Zwi Houminer and Jules Aarons 24 Jun. 1980 21 p refs
(AF Proj. 4643)
(AD-A094120; AFGL-TR-80-0194; AFGL-ERP-709) Avail: NTIS HC A02/MF A01 CSCL 04/1

Scintillation observations of VHF and UHF transmissions from geostationary satellites at Goose Bay have been used to study the average characteristics of the high latitude irregularity region. The paper describes the average time development and mean diurnal pattern of irregularities during 58 magnetic storms in 1971-1976. The diurnal variation at Goose Bay shows two peaks of scintillation activity. One peak occurs during the afternoon hours, while the second occurs during the night. The average diurnal pattern is independent of type of storm. Diurnal and seasonal effects appear only in the first day of storm commencement and not in the following days which show a very similar diurnal picture. GRA

N81-18594# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.
GEOPHYSICAL SIGNAL RECOGNITION
C. H. Chen 29 Jan. 1981 17 p refs To be presented at IEEE OCEAN, Boston, Sep. 1981
(Contract N00014-79-C-0494)
(AD-A094471; SMU-EE-TR-81-5) Avail: NTIS HC A02/MF A01 CSCL 08/11

Progress of pattern recognition as applied to various geophysical signals is reviewed. They include the teleseismic signals for nuclear detection and monitoring, exploration seismic signals for oil prospecting, marine seismic signals for study of subsurface structure of ocean floor, seismic signals for earthquake prediction, seismic signals for intrusion-detection, and geomagnetic signals for study of irregularities of the Earth's magnetic fields. With the exception of teleseismic signal, research in geophysical signal recognition is still in its infancy. We expect to see considerable research progress in the next decade. GRA

N81-18595# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE Technical Report, 2 Sep. - 22 Dec. 1979
Robert P. Pagliarulo, John P. Turtle, John E. Rasmussen, and Wayne I. Klemetti Jun. 1980 81 p refs
(AF Proj. 4600)
(AD-A094102; RADC-TR-80-189) Avail: NTIS HC A05/MF A01 CSCL 04/1

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. Riometer and magnetometer measurements of the polar propagation environment are presented as supplementary data. GRA

N81-18596# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
THE ELECTRICAL CONDUCTIVITY OF THE CRUST OF THE EASTERN UNITED STATES Technical Report, 1 Jul. 1975 - 30 Sep. 1980
Gene Simmons, Lou Caruso, and Frank Miller 14 Nov. 1980 27 p refs
(Contract N00014-76-C-0478)
(AD-A094334) Avail: NTIS HC A03/MF A01 CSCL 08/7

The electrical properties of the crust can be measured directly in the field or estimated for in situ conditions from suitable measurements made in the laboratory. Unfortunately, removal of rocks from their in situ location often changes significantly the characteristics of the rock that control the electrical conductivity; modelling those characteristics has been uncertain in the past. Thus, the problems that are inherent in the use of data measured in the laboratory to infer electrical properties of rocks in situ in the Earth's crust are (1) preventing sample bias, (2) duplicating the condition of rock in situ and at depth (including

pressure, temperature, and several other variables), and (3) modeling the properties of the pore fluids. In this paper, we report new data obtained in the laboratory for several representative samples from the eastern United States. We believe that we have modeled properly all characteristics of the samples that affect significantly the electrical properties. We use the data to estimate a standard electrical model for the upper crust of the eastern United States. GRA

N81-18597# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

CALCULATING INTERIOR DAYLIGHT ILLUMINATION WITH A PROGRAMMABLE HAND CALCULATOR

Harvey J. Bryan and Robert D. Clear Aug. 1980 34 p refs Presented at the Illum. Eng. Soc. Ann. Tech. Conf., Dallas, Tex., 24-28 Aug., 1980

(Contract W-7405-eng-48)

(LBL-11687; CONF-800882-1; EEB-W-80-11) Avail: NTIS HC A02/MF A01

A procedure is described for calculating interior daylight illumination using an inexpensive programmable hand calculator. The proposed procedure calculates illumination at any point within a room utilizing sky luminance distribution functions that are consistent with the CIE (Commission Internationale de L'Eclairage) overcast and Clear Sky functions. This procedure separates the light reaching the point being considered into three components: (1) light directly from the sky; (2) light after being reflected from external; and (3) internal surfaces. Two examples are presented in order to demonstrate the proposed procedure and indicate the speed with which the calculations are performed. DOE

N81-18598# Utah Univ., Salt Lake City. Earth Science Lab.

GRAV2D: AN INTERACTIVE 2-1/2 DIMENSIONAL GRAVITY MODELING PROGRAM, USER'S GUIDE AND DOCUMENTATION FOR REVISION 1

Carleen Nutter Nov. 1980 93 p refs

(Contract DE-AC07-79ID-12079)

(DOE/ID-12079/13; ESL-42) Avail: NTIS HC A05/MF A01

The GRAV2D is an interactive computer program used for modeling 2-1/2 dimensional gravity data. A forward algorithm is used to give the theoretical attraction of gravity intensity at a station due to a perturbing body given by the initial model. The resultant model can then be adjusted for a better fit by a combination of manual adjustment, one dimensional automatic search, and Marquardt inversion. GRAV2D has an interactive data management system for data manipulation and display built around subroutines to do a forward problem, a one dimensional direct search and an inversion. This is a user's guide and documentation for GRAV2D. DOE

N81-18599# California Univ., Livermore. Lawrence Livermore Lab.

RESOLUTION AND ERROR OF THE BACK PROJECTION TECHNIQUE ALGORITHM FOR GEOPHYSICAL TOMOGRAPHY

N. R. Burkhard Sep. 1980 63 p refs

(Contract W-7405-eng-48)

(UCRL-52984) Avail: NTIS HC A04/MF A01

The resolution and error properties of the back projection technique for geophysical tomography are examined. It is demonstrated that: the BPT algorithm always converges in the vector space corresponding to the nonzero eigenvectors; the mean error in the solution after convergence is the projection of the difference between the mean values of the starting model and the real solution in the vector space corresponding to the zero eigenvectors; and the covariance of the mean error is always finite. The resolving properties and error propagation characteristics of BPT for various tomographic views are discussed. The resolving power and error propagation characteristics of BPT are improved with tomographic views which encircle the region under investigation. Exploration strategy for geotomography with the BPT algorithm is discussed. The tradeoff between the resolving area and parameter contrast, cell size, and data accuracy is examined. DOE

N81-18600# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.

CONTROLLED-SOURCE AUDIOMAGNETOTELLURICS IN GEOTHERMAL EXPLORATION

S. K. Sandberg and G. W. Hohmann Sep. 1980 96 p refs

(Contract DE-AC07-79ID-12079)

(DOE/ID-12079/5) Avail: NTIS HC A05/MF A01

Theoretical and field tests indicate that the controlled-source audiomagnetotelluric (CSAMT) method provides an efficient means of delineating the shallow resistivity pattern above a hydrothermal system. Utilizing a transmitter overcomes the main limitation of conventional AMT: variable and unreliable natural source fields. Reliable CSAMT measurements can be made with a simple scalar receiver. Calculations for a half-space show that the plane wave assumption is valid when the transmitter is more than 3 skin depths away in the broadside configuration and more than 5 skin depths away in the collinear configuration. Three dimensional numerical modeling results for a bipole source 5 skin depths away compare well with those for a plane wave source, showing that the method is valid. Comparisons between 2D and 3D model results show that a 2D MT program can be used to interpret CSAMT data. A CSAMT survey produced apparent resistivity contour maps at four frequencies: 32, 98, 977, and 5208 Hz. These maps show the same features as a first-separation dipole-dipole resistivity map. DOE

N81-18601 California Univ., Los Angeles.

TRANSFER OF VISIBLE AND INFRARED RADIATION THROUGH THE TERRESTRIAL ATMOSPHERE Ph.D. Thesis

Subir Kumar Mitra 1980 244 p

Avail: Univ. Microfilms Order No. 8104023

The transfer is considered with a view towards answering the following two questions: can radiation field measurement be used to infer bulk aerosol properties and are conventional aerosol models adequate for radiation studies. The data from a polarimeter experiment were analyzed to show that the answers to both the questions are in the affirmative. The origin of a non-uniqueness inherent and generic to such remote radiation field measurements was identified and the implications are explained. An inadequacy that exists in the area of IR radiation transfer through a cloudless atmosphere was identified. This pertains to the failure of the Curtis-Godson (C-G) approximation in dealing with the 9.6 micro meters ozone absorption. A new approximation is described which improves the C-G method while preserving its simplicity. Calculations confirming the validity of the new approximation are also provided. Physical interpretation of why the new approximation is successful is also provided. Dissert. Abstr.

N81-18985*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ATMOSPHERIC MEDIA EFFECTS ON ARIES BASELINE DETERMINATION

S. C. Wu *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 1-6 ref (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-18602 Deutscher Wetterdienst, Offenbach am Main (West Germany).

DEVELOPMENT OF METEOROLOGICAL OBSERVATIONS IN SOUTHERN GERMANY SINCE 1700 [DIE ENTWICKLUNG DER METEOROLOGISCHEN BOEBACHTUNGEN IN SUED-WESTDEUTSCHLAND BIS 1700]

Fritz Klemm 1979 67 p refs In GERMAN

(ISBN-3-88148-169-9; ISSN-0072-4122) Avail: Issuing Activity

The historical development of meteorological observations till 1700 in Southwest Germany are reported. Registrations of meteorological and climatological components in agricultural, scientific, and social historic research are presented. Climatology

and weather observations are of historical importance and are the foundation of modern meteorology. Transl. by E.A.K.

N81-18603 Deutscher Wetterdienst, Offenbach am Main (West Germany).

ONE HUNDRED YEARS WEATHER SERVICE IN BAVARIA, 1878-1978 [100 JAHRE WETTERDIENST IN BAYERN, 1878-1978]

Ernst Lingelbach 1979 36 p refs In GERMAN

(ISBN-3-88148-171-0; ISSN-0072-4122) Avail: Issuing Activity

The history of the weather service in Bayern over the last 100 years is reviewed. The climate for the region over the same time period is discussed, with temperature and precipitation *variation charts included.* E.D.K.

N81-18604*# *Texas A&M Univ., College Station. Dept. of* Meteorology.

THE DEVELOPMENT OF CONVECTIVE INSTABILITY, WIND *SHEAR, AND VERTICAL MOTION IN RELATION TO* CONVECTION ACTIVITY AND SYNOPTIC SYSTEMS IN AVE 4 Final Report

James G. Davis and James R. Scoggins Washington NASA Feb. 1981 146 p refs

(Contract NAS8-31773)

(NASA-CR-3386; M-342) Avail: NTIS HC A07/MF A01 CSCL 04B

Data from the Fourth Atmospheric Variability Experiment were *used to investigate conditions/factors responsible for the* development (local time rate-of-change) of convective instability, wind shear, and vertical motion in areas with varying degrees of convective activity. AVE 4 sounding data were taken at 3 or 6 h intervals during a 36 h period on 24-25 April 1975 over approximately the eastern half of the United States. An error analysis was performed for each variable studied. Author

N81-18605# *Stanford Univ., Calif. Inst. for Plasma Research.*

NOTES FROM THE STANFORD SUN-WEATHER WORKSHOP

C. Robert Clauer Dec. 1980 35 p refs Workshop held in Stanford, Calif., 11-15 Aug. 1980

(Contract N00014-76-C-0207)

(SU-SUIPR-825) Avail: NTIS HC A03/MF A01

The workshop was on solar variability and its relationship to weather and climate. The purpose of the workshop was to allow a free exchange of ideas between between a group of solar physicists, geophysicists and meteorologists interested in Sun-weather relationships. T.M.

N81-18606*# National Aeronautics and Space Administration. *Marshall Space Flight Center, Huntsville, Ala.*

A PRELIMINARY LOOK AT AVE-SESAME 6 CONDUCTED ON 7-8 JUNE 1979

Michael July (Texas A & M Univ., College Station) and Robert E. Turner Jan. 1981 58 p refs

(NASA-TM-82398) Avail: NTIS HC A04/MF A01 CSCL 04B

The Atmospheric Variability Experiment - Severe Environmental Storms and Mesascale Experiment 6 period is described. Data collected, synoptic conditions and severe and unusual weather are discussed. S.F.

N81-18607*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AVE-SESAME 6: 25-MB SOUNDING DATA

Meta E. Sienkiewicz (Texas A & M Univ.), Luke P. Gilchrist (Tenn. Univ. Space Inst.), and Robert E. Turner Jan. 1981 305 p refs

(NASA-TM-82397) Avail: NTIS HC A14/MF A01 CSCL 04B

The rawinsonde sounding program for the AVE-SESAME 6 experiment is described and tabulated data at 25 mb intervals from the surface to 25 mb for the 23 National Weather Service and 15 special stations participating in the experiment are presented. Soundings were taken at 3 h intervals beginning at 1200 GMT on June 7, 1979, and ending at 1200 GMT on June 8, 1979 (nine sounding times). The method of processing is discussed briefly, estimates of the rms errors in the data presented, an example of contact data given, reasons given for the termination of soundings below 100 mb, and soundings are *listed which exhibit abnormal characteristics.* T.M.

N81-18608*# National Aeronautics and Space Administration. *Hugh L. Dryden Flight Research Center, Edwards, Calif.*

CLIMATOLOGICAL CHARACTERISTICS OF HIGH ALTITUDE WIND SHEAR AND LAPSE RATE LAYERS

L. J. Ehernberger and Nathaniel B. Guttman Feb. 1981 99 p refs

(NASA-TM-81353; H-1132) Avail: NTIS HC A05/MF A01 *CSCL 04B*

Indications of the climatological distribution of wind shear and temperature lapse and inversion rates as observed by *rawinsonde measurements over the western United States are* recorded. Frequencies of the strongest shear, lapse rates, and inversion layer strengths *were observed for a 1 year period of* record and were tabulated for the lower troposphere, the upper troposphere, and five altitude intervals in the lower stratosphere. *Selected bivariate frequencies were also tabulated. Strong wind* shears, lapse rates, and inversion are observed less frequently as altitude increases from 175 millibars to 20 millibars. On a *seasonal basis the frequencies were higher in winter than in* summer except for minor influences due to increased tropopause altitude in summer and the stratospheric wind reversal in the *spring and fall.* S.F.

N81-18609# Royal Netherlands Meteorological Inst., De Bilt. *Meteorologisch Onderzoek.*

SPECIFICATIONS FOR AUTOMATIC MEASURING STATIONS. PART 3: EXTRACTION OF SYNOPTIC CODES FROM THE METBAS-RECORD [SPECIFIKATIES VOOR AUTOMATISCHE MEETSTATIONS. NO. 3: EXTRACTE SYNOPTISCH CODEBERICHT UIT METBAS-RECORD]

P. C. T. vanderHoeven 1980 25 p In DUTCH

(KNMI-V-323-Pt-3) Avail: NTIS HC A02/MF A01

The METBAS-record (recordings from hourly meteorological observations) is examined. The hourly record keeping is of importance to the automatic measuring station and the meteorologist and reflects the final results of data reduction, which are executed on the premises. The METBAS-record serves as a quick and accurate set of references in weather forecasting, especially *in times of emergency.* Transl. by E.A.K.

N81-18610# Royal Netherlands Meteorological Inst., De Bilt. *Fysisch Meteorologisch Onderzoek.*

COMPARISON BETWEEN HIGH ALTITUDE WIND OBSERVATION WITH RADAR AT DE BILT AND THE THEODOLITE AT CABAUW [VERGELIJKING TUSSEN HOOGTEWINDWAARNEMING MET RADAR DE BILT EN THEODOLIET CABAUW]

B. Oemraw Feb. 1980 54 p refs In DUTCH

(KNMI-V-352) Avail: NTIS HC A04/MF A01

Two methods for high altitude wind observation in the Netherlands (radar and theodolite) were compared. Both methods (radiosondes/theodolite and radiosondes/radar) gave equally good results. It is suggested that low altitude measurements can be done by theodolite, while higher altitude measurements can be performed by radar. Transl. by E.A.K.

N81-18611# Royal Netherlands Meteorological Inst., De Bilt. *Dynamische Meteorologie.*

THE PERSISTANCE ON VERY SHORT TERM OF LOW CLOUDS ABOVE A NUMBER OF DUTCH AIRFIELDS [DE PERSISTENTIE OP ZEER KORTE TERMIJN VAN LAGE BEWOLKING OP ENKELE NEDERLANDSE VLIEGVELDEN]

J. Roodenburg 1980 43 p ref In DUTCH

(KNMI-V-353) Avail: NTIS HC A03/MF A01

Meteorological Information Services at civilian aiports in the Netherlands provide hourly trend forecasts. Changes in low altitude cloud persistence are recorded. Clouds at altitudes between 500 and 1000 feet appear most persistent. Charts have been made up to aid in the forecasting of low altitude clouds in airports. The material is useful as a basis for an objective verification system. Transl. by E.A.K.

N81-18612# Royal Netherlands Meteorological Inst., De Bilt. *Bureau Vakopleidingen.*

WIND MAXIMA AT LOW ALTITUDE IN THE ATMOSPHERE. [WINDMAXIMA OP GERINGE HOOGTE IN DE ATMOSFEER]

C. J. vanderHam 1980 35 p refs In DUTCH Presented at Synoptics Symp., De Bilt, Netherlands, Nov. 1979

(KNMI-V-354) Avail: NTIS HC A03/MF A01

Wind maxima at low altitudes in the atmosphere are discussed. Three different kinds of winds are identified: nightly winds, synoptic winds, and orographic winds. Maxima are not the same winds as jet streams, though they can reach high speeds (50 - 80 kts). It is concluded that the maxima winds are of great importance in weather forecasting, especially for aviation. Transl. by E.A.K.

N81-18613# Royal Netherlands Meteorological Inst., De Bilt. Luchtvaart Meteorologische Dienst.

WINDSHEAR DURING HEAVY SHOWERS [WINDSHEAR BIJ ZWARE BUIEN]

L. J. Beenker 1980 30 p refs In DUTCH Presented at Synoptics Symp., De Bilt, Netherlands, Nov. 1979

(KNMI-V-355) Avail: NTIS HC A03/MF A01

The occurrence of troubleshooting for windshears during heavy rainstorms and its meaning to aviation is discussed. Three different kinds of windshears are identified. Their interference with air traffic, their causes, and heroic measures in the prevention of accidents are enumerated. It was found that the most frequently reported windshears are those occurring during extremely heavy winds. Transl. by E.A.K.

N81-18614# Royal Netherlands Meteorological Inst., De Bilt. Fysisch Meteorologisch Onderzoek.

A TEST OF A NEW COMPUTING METHOD OF OPEN-WATER EVAPORATION ACCORDING TO PENMAN TO PROVIDE FAST INFORMATION REGARDING EVAPORATION [EEN TEST VAN EEN NIEUWE BEREKENINGSWIJZE VAN DE OPEN-WATER VERDAMPING VOLGENS PENMAN TEN BEHOEVE VAN SNELLE VOORLICHTING OMTRENT DE VERDAMPING]

H. A. R. deBruin and W. N. Lablans 1980 10 p refs In DUTCH

(KNMI-V-357) Avail: NTIS HC A02/MF A01

A quick system to obtain data on information on open-water evaporation is discussed. Speedy computation of information is of importance to horticulture and agriculture. The new system, the Penman formula, provides information over a week's period and is almost immediately available at the end of the period. One formula for computation of open-water evaporation is calculated on the degree of cloudiness and global radiation. Computations made over the last decade, by different methods, were compared and standardized. Transl. by E.A.K.

N81-18615# Aeronautical Research Labs., Melbourne (Australia).

VARIABLE EXPOSURE CLOUD DROP SAMPLING DEVICE

F. W. Skidmore May 1980 17 p refs

(AD-A094133; ARL/MECH/ENG/TM-400) Avail: NTIS HC A02/MF A01 CSCL 01/3

This report describes the design and operation of a variable exposure cloud drop sampling device, as used during Nomad anti-icing trials in Australia and in the United Kingdom. GRA

N81-18616# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

TESTS OF SPECTRAL CLOUD CLASSIFICATION USING DMSP FINE MODE SATELLITE DATA

James T. Bunting and Ronald F. Fournier 2 Jun. 1980 44 p refs

(AF Proj. 6670)

(AD-A094119; AFGL-TR-80-0181; AFGL-ERP-704) Avail: NTIS HC A03/MF A01 CSCL 04/2

A computer-based processor for satellite imagery was tested on samples of DMSP visible and IR imagery data smoothed to 0.6 n mi resolution. The data were displayed on the AFGL Man-computer Interactive Data Access System so that meteorologists could label small areas (25 x 25 n mi) with one of nine possible cloud categories from the AF 3D Nephanalysis Program (3DNEPH). The computer-based processor labeled the same areas by computing a two dimensional fast Fourier transform (FFT) and comparing the results to average wavenumber spectra for the cloud categories. Classification accuracies were 65% for visible, 65% for IR and 81% for combined data. The classification accuracies were appreciably better than chance and a simplified processor which used only the averaged values of satellite data over an area. Accuracies improved in some categories were merged. The results were also compared to a cloud typing procedure in the 3DNEPH and to some earlier studies. The results were generally good for categories with small-scale cloud features such as cumulus or cirrus clouds, but the overall accuracy of classification for all cloud categories was not significantly better than verifications cited in earlier studies. Two potential refinements to the spectral processors, namely, removing the effects of backgrounds such as land, water, and snow cover and minimizing sensitivity to varying fractional cloud cover from case to case, are also discussed. GRA

N81-18617# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.

SURVEY OF SENSORS FOR AUTOMATED TACTICAL WEATHER OBSERVATIONS

Eugene Y. Moroz and Frederick J. Brousaides 25 Jun. 1980 46 p refs

(AF Proj. 6670)

(AD-A094121; AFGL-TR-80-0195; AFGL-IP-288) Avail: NTIS HC A03/MF A01 CSCL 04/2

Current requirements for tactical weather systems at fixed and bare-base airfields necessitate an upgrading of meteorological sensor capability, system automation, and a range of data dissemination options. A program has been initiated at the Air Force Geophysics Laboratory to implement these objectives. In the first phase of this program, a survey of the state-of-the-art has been made for the identification of equipment suitable for such a system. Government inventoried instrumentation, as well as those from commercial sources, have been considered. Criteria to be used in sensor selection will include both accuracy and the ability to operate trouble free over a wide range of environmental extremes. When appropriate, in-house programs will be initiated to correct deficiencies. During the coming year, field tests and intercomparisons will be made of selected sensors. Instrumentation will eventually be integrated into an automated system with local and/or remote display of weather elements tailored to user requirements. GRA

N81-18618# Royal Netherlands Meteorological Inst., De Bilt. Oceanografisch Onderzoek.

INTRODUCTION TO A THEORY OF MIXED LAYERS AT SEA [INLEIDING THEORIE MENGLAAG IN ZEE]

R. Dorrestein 1980 32 p refs In DUTCH

(KNMI-V-340) Avail: NTIS HC A03/MF A01

An introduction to the mixed layer theory in seas is presented. Two ways of turbulence energy supply are discussed: (1) turbulence energy supplied to the ocean surface (by wave braking and possibly by wind) and (2) when a downward flow beginning at the surface occurs and the mixed layer has to be vertically layered. Guidelines for calculation of the thickness of the mixed layer are provided. Transl. by E.D.K.

N81-18619# Royal Netherlands Meteorological Inst., De Bilt. Meteorologisch Onderzoek.

SPECIFICATION FOR AUTOMATIC MEASURING STATIONS. PART 2: REVISIONS FOR ATMOSPHERIC PRESSURE; REVISIONS FOR WIND PRESSURE [SPECIFIKATIES VOOR AUTOMATISCHE MEETSTATIONS. NO. 2: HERZIENING LUCHTDRUK HERZIENING WIND]

P. C. T. VanderHoeven Apr. 1980 14 p refs In DUTCH

(KNMI-V-323-Pt-2) Avail: NTIS HC A02/MF A01

Measuring methods and standards for atmospheric pressure are discussed. The importance of atmospheric pressure measurements and the calculation of wind pressure, speed, and direction for air and sea traffic are enumerated. The use of wind vanes in this process is mentioned. Revisions on computation methods are included. Transl. by E.A.K.

N81-18620 Oklahoma State Univ., Stillwater.

DEVELOPMENT OF AN IMPROVED DEGREE-DAY CONCEPT BY ANALYSIS OF HISTORICAL WEATHER DATA FOR PREDICTING ENERGY REQUIREMENTS OF BUILDINGS Ph.D. Thesis

Nader Sharabianlou 1980 161 p

Avail: Univ. Microfilms Order No. 8103331

Computational experiments were conducted to determine the effects of weather parameters on thermal response of buildings and to identify the significant environmental parameters. The significant environmental parameters were utilized in development of an improved degree day concept. A methodology was developed estimating energy demand of commercial structures via simple expressions which require evaluation of the product of two terms. These terms are distinct functions of the significant building and weather parameters. A procedure for estimating seasonal heating and cooling efficiency parameters was developed for estimating energy consumption. The significant environmental parameters identified by sensitivity analysis of the thermal response of buildings to perturbations in the climate were bulb temperature, solar insolation, humidity ratio difference of indoor and outdoor air, and the daily temperature range. Dissert. Abstr.

N81-18621 State Univ. of New York at Albany.
SYNOPTIC CASE STUDIES OF CYCLONE/ANTICYCLONE COUPLETS OVER NORTH AMERICA Ph.D. Thesis
James Stephen Boyle 1980 375 p
Avail: Univ. Microfilms Order No. 8100291

The first case begins with anticyclogenesis taking place in Alaska. It is shown that in quasi-geostrophic framework both the thermal and dynamic forcings are nearly equal in producing subsidence and height rises. The anticyclogenesis takes place on the cold side of a pronounced baroclinic zone as defined by the 100-500 mb thickness. The movement of the anticyclone southward is seen to be a dual process. Cold advection produces height rises to the southeast of the center, while the dynamic (vorticity) forcing is active in producing height rises closer to the anticyclonic center. The other case study is an example of explosive cyclogenesis. In the QG framework the cyclone was better forecast than the anticyclone. In the incipient stage the cyclone is developing on a very strong baroclinic zone. Thus the thermal forcing is initially the most important producing lower level height falls. The dynamic forcing increases in importance as the storm matures. The anticyclone is chiefly dynamically forced, forming downstream of the upper level ridge.
Dissert. Abstr.

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-18622# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
A NUMERICAL TECHNIQUE FOR THE CALCULATION OF DISPERSION RELATIONS AND MODE FUNCTIONS FOR UPPER OCEAN INTERNAL WAVES Final Report
Irvin W. Kay, Patricia J. Draper, and Wasyl Wasykiwskyj Oct. 1980 78 p refs
(Contract MDA903-79-C-0202)
(AD-A094240; AD-E500235; IDA-P-1491; IDA/HQ-80-22393) Avail: NTIS HC A05/MF A01 CSCL 08/3

This paper is concerned with calculating the internal wave eigenfunctions and dispersion relations for an infinitely deep ocean with an arbitrary Vaisala frequency profile. The method involves numerically integrating the differential equation from a depth where the profile is essentially an exponential function, and therefore where the eigenfunctions are known explicitly, to the surface where each eigenfunction must vanish. The equation that is implied by the surface boundary condition determines the dispersion relation, which is obtained numerically by solving the equation by means of the method of regula falsi. A computer program that performs the necessary calculations is described and listed. GRA

N81-18623# Naval Postgraduate School, Monterey, Calif.
THE ONE-DIMENSIONALITY OF THE UPPER OCEAN MIXING AND THE ROLE OF ADVECTION DURING THE POLE EXPERIMENT M.S. Thesis
Ricky Eugene Shook Sep. 1980 73 p refs
(AD-A094551) Avail: NTIS HC A04/MF A01 CSCL 08/3

A one dimensional mixed layer model (Garwood, 1976, 1977) is used to simulate the mixed layer depth and temperature observed during POLEX, a component of the North Pacific Experiment. POLEX occurred during January-February 1974 with mid-ocean observations (35 deg n, 155 deg w) of temperature and salinity made from R/P FLIP, while FLIP was under free drift conditions. The results of this simulation show that apparent horizontal advection, due to the drift of R/P FLIP, was important in the heat and salinity budgets, but that vertical mixing and mixed layer depth changes were controlled primarily by the one dimensional response of the turbulent kinetic energy budget to the local atmospheric forcing. Occasionally, surface salinity flux, due to large precipitation rates, can significantly alter (on the order of tens of meters) the thickness of ocean surface turbulent boundary layer, with demonstrated decrease in thickness during a single period of strong precipitation. GRA

N81-18624# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Scholarly Communication with the People's Republic of China.
OCEANOGRAPHY IN CHINA. A TRIP REPORT OF THE AMERICAN OCEANOGRAPHY DELEGATION
Apr. 1980 112 p refs Sponsored in part by International Communication Agency and National Endowment for the Humanities
(PB81-114860; CSCPRC-9; ISBN-0-309-03046-3; LC-80-81422) Avail: NTIS HC A06/MF A01 CSCL 08J

An oceanographic delegation sponsored by the Committee on Scholarly Communication with the People's Republic of China visited China from September 25 to October 22, 1978. Some of the subject areas discussed by the Bureau and the Chinese Academy of Sciences were: marine and geophysics; shore processes and education. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-18625 California Univ., San Diego.
VASOMOTION PATTERNS IN SKELETAL MUSCLE IN NORMAL AND HYPERTENSIVE RATS Ph.D. Thesis
Jeffrey Lynn Borders 1980 144 p
Avail: Univ. Microfilms Order No. 8103782

The vasomotor patterns of skeletal muscle arterioles were studied in the rat spinotrapezius muscle in relation to resistance changes associated with the onset of hypertension. A theoretical model was proposed for vasomotion. It is based on a slowly diffusible circulating vasoconstrictor. The model links changes seen in the vasomotion patterns to changes in vessel wall properties. A computer simulation was done for the case of increased vessel wall thickness. The simulation showed that thicker vessel wall is more stable to diffusion related oscillations and is less likely to show spontaneous diameter changes. The simulation also predicted graded diameter responses and a shift to lower frequencies for the thicker wall structure. These features agree with the experimentally observed patterns of vasomotion in normal and hypertensive animals. Dissert. Abstr.

N81-18626 California Univ., Los Angeles.
THE BACTERIAL PRODUCTION OF METHANE IN MARINE SEDIMENTS Ph.D. Thesis
Paul Robin Doose 1980 262 p
Avail: Univ. Microfilms Order No. 8102822

The sequence of biodiagenetic reactions that occurs in marine sediments is determined by the free energy of the reaction. This leads to a succession of chemotrophic respiratory electron acceptors which pass through O2, NO3(-), SO4(=), HCO3(-) and ends with the fermentation of organic matter. In Santa Barbara Basin, this sequence starts with SO(=) reduction due to the anoxic condition of the bottom water. An advection model was developed. It is shown that the advective flux is small compared to other sedimentary processes. An advective flux of water does not leave the sediment water interface, since sedimentation is always faster than advection. A procedure for dating subaqueous sediment cores was developed which is easy to use, inexpensive, and gives a continuous profile of ages. Scatter in the water

content data for Santa Barbara Basin appears to be a real property of the sediment which correlates with known indicators of paleoclimates. Similar time correlated fluctuations in water content are found in San Pedro, San Nicolas, and Tanner Basins.
Dissert. Abstr.

N81-18627*# Desert Research Inst., Reno, Nev. Atmospheric Science Center.
INVESTIGATIONS RELATED TO EVALUATION OF ULTRA-MICROFLUOROMETER Final Report, 1 Nov. 1979 - 31 Dec. 1980
Bruce Whitcomb Feb. 1981 43 p refs
(Contract NAG2-14)
(NASA-CR-163972) Avail: NTIS HC A03/MF A01 CSCL 06B

High resolution emission and excitation fluorescent spectra were obtained for several samples in an effort to determine the optimum operational design for the instrument. The instrument was used to determine the required nature of a sample which could be detected, and in so doing, several different sample preparation techniques were considered. Numerous experiments were performed to determine the capabilities of the instrument with regard to the detection of suitably prepared virus specimens. Significant results were obtained in several areas. The fluorescent spectra indicated that substantial changes in the laser might be used advantageously to greatly improve the performance of the instrument. In the existing configuration, the instrument was shown to be capable of detecting the presence of suitably prepared virus samples. Author

N81-18628# Rice Univ., Houston, Tex. Coal Combustion Systems Div.
BIOFILM DEVELOPMENT AND DESTRUCTION Final Report
W. G. Characklis Sep. 1980 313 p refs Sponsored by EPRI
(EPRI Proj. 902-1)
(EPRI-CS-1554) Avail: NTIS HC A14/MF A01

Fouling biofilm formation, its effects on energy losses and, finally, its destruction were studied. Special apparatus and simulated cooling water were used in the laboratory. A tubular reactor and an annular reactor consisting of a stationary outer cylinder and a rotating inner cylinder were used. Experiments and apparatus were designed to isolate the effects of biofouling from other processes such as corrosion or particulate fouling which could complicate data interpretation. Biofilm development rate is affected by fluid velocity, wall temperature, and nutrient concentration. Increase in fluid frictional resistance, resulting from biofilm formation, is a good indication of biofouling after the biofilm reaches a critical thickness corresponding to the viscous sublayer thickness. Changes in heat transfer are the net result of decrease in conductive heat transfer due to biofilm accumulation and increase in convective heat transfer due to increase in fluid frictional resistance. Destruction of biofilms by chemical oxidants is a diffusion limited process. Consequently, oxidants are more effective when applied at high concentration for short periods. High flow rates enhance biofilm destruction by oxidants. Several promising techniques for monitoring biofouling film development and destruction were developed and tested. DOE

N81-18629# National Academy of Sciences - National Research Council, Washington, D. C. Div. of Biological Sciences.
RESEARCH PRIORITIES IN TROPICAL BIOLOGY
1980 130 p refs
(PB81-114902; ISBN-0-309-03043-9; LC-80-15773) Avail: NTIS HC A07/MF A01 CSCL 06F

Partial contents include: biological inventory; tropical ecosystem studies; studies of tropical aquatic systems; monitoring forest population; conversion rates of tropical moist forest; land use, population growth, and food production; preservation of the forests; and inventory of tropical organisms. GRA

N81-18630# Silesian Medical Academy, Katowice (Poland). Dept. of Pharmacology.
CHRONIC TOXICITY OF LEAD AND CADMIUM. 1: CHANGES IN THE CENTRAL NERVOUS SYSTEM OF THE PARENTAL GENERATION OF RATS AFTER CHRONIC INTOXICATION WITH LEAD AND CADMIUM Interim Report
Zbigniew S. Herman, Krystyna Kmieciak-Kolada, Ryszard Szkilnik, Rxszard Brus, and Kornel Ludyga Jan. 1980 23 p refs
(Contract EPA-JB5-531-1)
(PB81-110850; EPA-600/1-80-012) Avail: NTIS HC A02/MF A01 CSCL 06T

Treatments consisted of two levels of lead (5 or 50 ppm), two levels of cadmium (0.1 or 5 ppm), and two combined dosages (5 ppm lead and 0.1 ppm cadmium, or 50 ppm lead and 5 ppm cadmium). Treatments were administered in buffered drinking water. The lower dosages generally produced hyperactivity, while higher dosages produced hypoactivity. Effects of lead and cadmium on biogenic amines varied with dose and area of the brain. Biochemical analysis of blood and urine showed no changes in the hematocrit or hemoglobin, but the activity of Delta-ALA dehydratase and serum phosphatase were differentially affected. Concentrations of lead and cadmium in the liver and kidney increased, and positive interaction effects were noted.
GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-18631 California Univ., Los Angeles.
THE ULTRASTRUCTURAL BASIS FOR THE PHOTOMECHANICAL RESPONSE IN THE PHOTORECEPTORS OF THE VERTEBRATE RETINA Ph.D. Thesis
Gerald E. Adomian 1980 104 p
Avail: Univ. Microfilms Order No. 8103980

The mechanical response of rod and cone cells to light, in certain vertebrate retinas, involves extensive changes in length in the myoid region of the inner segment. The objective was to determine the morphological basis for this phenomenon. Retinas from a hybrid of Ictalurus melas and nebulosus were prepared for electron microscopic examination after varying degrees of light and dark adaptation. Of the 58 animals used in the study, 16 were used for the quantitative analysis. Myoids of the shortened cells consist of a supranuclear region 4 to 7 microns in diameter and 9 to 5 microns long, in rods and cones, respectively, which contains numerous ribosomes, glycogen, Golgi apparatus, smooth surfaced cytomembranes delimiting vacuolar spaces, and membrane bound granules with a particular content. The myoids of extended cells have a supranuclear region, but unlike shortened cells, also have a long thin stalk. With the appearance of the stalk, a new structural component was observed--a bundle of uniformly distributed microtubules extending the length of the stalk. Dissert. Abstr.

N81-18632 Rhode Island Univ., Kingston.
AORTIC BLOOD FLOW ESTIMATION FROM PRESSURE MEASUREMENTS Ph.D. Thesis
Shankar Muthukrishnan 1980 291 p
Avail: Univ. Microfilms Order No. 8103060

The method is based on modeling aorta as a distributed, nonuniform thin walled tube with exponential variations of geometric and viscoelastic properties. An experimental transfer function, between selected proximal and distal points along the descending thoracic aorta, was computed as the ratio of the corresponding frequency components of the measured pressure waveforms. Model transfer function could be calculated from nominal values of the aortic model. A cost function was defined as mainly a function of the mismatch between the experimental transfer function and the model transfer function. A nonlinear transformation of the cost function was performed to assure positive real values of the aortic model parameters. To the cost function formulation an additional term containing a relationship between local pressure and radius was included in order to avoid multiple solutions. A computerized optimization technique utilizing a variation of Powell's derivative free algorithm was employed to minimize the cost function, yielding the optimal parameters for the aortic model. Dissert. Abstr.

N81-18633*# Texas Univ., Galveston. Medical Branch.
SKYLAB: CYTOGENETIC STUDIES OF BLOOD (EXPERIMENT MILL) Final Report

Lillian H. Lockhart 1981 22 p refs
(Contract NAS9-13102)
(NASA-CR-163970) Avail: NTIS HC A02/MF A01 CSCL 06P

Preflight and postflight chromosomal analyses of space flight crews are presented. Special attention is given to findings suggestive of exposure to ionizing radiation. Information was obtained by study of persons receiving an external body source, such as, therapeutic dosage or those accidentally exposed. Others receiving radiation exposure from an internal source, such as the decay of radioisotopes administered for diagnosis or treatment, were also analyzed. T.M.

N81-18634*# Santa Clara Univ., Calif.
PRELIMINARY REPORT: BIOMEDICAL CONSIDERATIONS FOR FUTURE MANNED SPACE FLIGHTS
Faren Ray Akins 1 Oct. 1978 93 p refs
(Contract NCA2-OR685-805)
(NASA-CR-152383) Avail: NTIS HC A05/MF A01 CSCL 06P

The behavioral, psychological, and sociological aspects of space travel, particularly with emphasis on longer duration missions, are discussed along with the biomedical aspects of space flight. These factors may strongly interact with the various psycho-social factors and as such they stand as an immensely important area of concern in and of themselves. A foundation for understanding weightlessness related medical problems through a discussion of the history of symptoms reported specific details on the major areas of concern and approaches to their investigation are presented. Also, discussion is given to the possibility of various countermeasures. Some indication of the effects of various biomedical changes in performance are also covered. T.M.

N81-18635*# Wisconsin Univ. - Madison.
NASA: BIOMEDICAL APPLICATIONS TEAM Final Report, 1 Jul. 1976 - 31 Dec. 1978
15 Jan. 1979 155 p refs
(Contract NAS5-23500)
(NASA-CR-166636) Avail: NTIS HC A08/MF A01 CSCL 06B

Biomedical applications of NASA technology are summarized and discussed. Included are: diagnostic devices, treatment aids, design improvements and patient tracking systems. S.F.

N81-18636*# National Aeronautics and Space Administration, Washington, D. C.
GNOTOBIOLOGY IN MODERN MEDICINE
G. I. Podoprigora Sep. 1980 20 p refs Transl. into ENGLISH from Priroda (USSR), no. 6, Jun. 1978 p 3-15 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Lab. of Experimental Simulations, Academy of Medical Sciences (USSR)
(Contract NASw-3199)
(NASA-TM-76362) Avail: NTIS HC A02/MF A01 CSCL 06E

A review is given of currently accepted theories and applications of gnotobiology. A brief history of gnotobiology is supplied. Problems involved in creating germ-free gnotobiota and the use of these animals in experimental biology are cited. Examples of how gnotobiology is used in modern medical practice illustrate the future prospects for this area of science. Author

N81-18637*# National Aeronautics and Space Administration, Washington, D. C.
AGE CHARACTERISTICS OF CHANGES IN INVERTASE ACTIVITY OF THE MUCOUS MEMBRANE OF THE SMALL INTESTINE
K. R. Rakhimov and N. V. Aleksandrova Sep. 1980 6 p refs Transl. into ENGLISH from Uzbeksk. Biol. Zh. (USSR), no. 3, May - Jun. 1979 p 41-43 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76385) Avail: NTIS HC A02/MF A01 CSCL 06S

Rats of varying ages were subjected to stress from heat, cold, and hydrocortisone injection. Invertase activity in homogenates of small intestine mucous membranes was studied following sacrifice. Invertase activity was low in young animals, but increased sharply in 30 day old ones, remaining at a relatively constant level until old age. The study concludes that the stress hormone (corticosteroids, etc.) levels in the blood, which affects the formation of enteric enzyme levels and activities, and that age related peculiarities in invertase activity are a consequence of altered hormone status and epitheliocyte sensitivity. Author

N81-18638*# National Aeronautics and Space Administration, Washington, D. C.
RHEOGRAPHY IN WEIGHTLESSNESS
I. Kasyan and V. Turchaninova Oct. 1980 6 p Transl. into ENGLISH from Med. Gazeta (USSR), 23 Feb. 1980 p 3 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by USSR Ministry of Public Health
(Contract NASw-3199)
(NASA-TM-76439) Avail: NTIS HC A02/MF A01 CSCL 06S

Small-scale rheographic devices for use on a space ship were developed and used during flights for the study of blood flow in vascular regions. The processes that occur during space flight and the adaptation of the human body to weightlessness are understood. The future condition of the cosmonauts' health is predicted. Author

N81-18639*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF THE STUDY OF THE VESTIBULAR APPARATUS AND THE FUNCTIONS OF THE PERCEPTION OF SPACE IN COSMONAUTS (PRE- AND POST-FLIGHT OBSERVATIONS)
I. Ya. Yakovleva, L. N. Kornilova, I. K. Tarasov, and V. N. Alekseyev Jan. 1980 17 p refs Transl. into ENGLISH of "Resultaty Issledovaniya Vestibulyarnogo Apparta i Funktsii Vospriyatiya Prostranstva Kosmonavtov (Pred- i Posleopoletnyye Osbledovania)" Moscow, 1980 p 22 Presented at the 11th Joint Soviet-Am. Working Group on Space Biol. and Med., Moscow, Oct. 1980 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Ministry of Health, Moscow
(Contract NASw-3198)
(NASA-TM-76485) Avail: NTIS HC A02/MF A01 CSCL 06P

The effect of the set of space flight factors caused a change in the activity of the vestibular apparatus and the spatial perception function. More significant and longer shifts were observed during expeditions of great duration. The detected disorders (increase in reactivity of the otolithic apparatus, decrease in sensitivity of the cupula receptor, deterioration in the perception accuracy, etc.) had a definite tendency to be restored. The primary damage to the otolithic reflex (changes were found in practically all the subjects) is probably caused by the specific effect of zero gravitation, and apparently, may be one of the trigger mechanisms for discrepancy in the activity of the sensory systems, disorders in the correcting function of the cerebellum, and central vestibular formations. E.D.K.

N81-18640*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF MEDICAL RESEARCH DURING THE 175-DAY FLIGHT OF THE THIRD MAIN CREW ON THE SALYUT-6-SOYUZ ORBITAL COMPLEX
A. D. Yegorov, O. G. Gazenko, ed., and A. M. Genin, ed. Jan. 1981 209 p refs Transl. into ENGLISH of the mono. "Rezultaty Meditsinskikh Issledovaniy vo Vremya 175 Sutochnogo Poleta Tretyego Osnovnog Ekipazha na Orbitalnom Komplekse Salyut-6-Soyuz" Moscow, 1980 p 299 Presented at the 11th Meeting of the Joint Soviet-Am. Working Group on Space Biol. and Med., Moscow, Oct. 1980 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Sciences, Moscow, and Ministry of Health, Moscow
(Contract NASw-3199)
(NASA-TM-76450) Avail: NTIS HC A10/MF A01 CSCL 06P

Preflight, inflight and postflight procedures, and results of cardiopulmonary, neuromuscular, locomotor, biochemical, hematological, immunological, microbiological, and water salt metabolism and kidney function studies in the 175 day flight of the 3rd main crew aboard the Salyut 6 Soyuz orbital station are

discussed. Prophylactic measures to prevent unfavorable effects of flight factors and the return to Earth gravity are described. Comparisons are made with the results of similar tests and measures in shorter space flights. Some recommendations for further research are listed. E.D.K.

N81-18641*# National Aeronautics and Space Administration, Washington, D. C.
THE USE OF ANTI-GRAVITY SUITS FOR THE CONTROL OF CRITICAL INTRA-ABDOMINAL HEMMORHAGE
Stein Kravik and Knud Landmark Aug. 1980 10 p refs Transl. into ENGLISH from Tidsskr. Morske Laegforen. (Norway), v. 99, no. 30, 1979 p 1498-1500 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-75786) Avail: NTIS HC A02/MF A01 CSCL 06B

The history and use as well as the physiology of the use of antigravity suits for the control of critical intra-abdominal hemorrhages is reviewed. The use of this suit is highly recommended, especially for first aid. Author

N81-18642# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
A PREDICTOR OF HUMAN VISUAL PERFORMANCE (PREVIP) AT FORM DISCRIMINATION TASKS
Roger A. Gagnon Dec. 1980 42 p refs
(AF Proj. 7233)
(AD-A093991; AFAMRL-TR-80-1) Avail: NTIS HC A03/MF A01 CSCL 05/5

This technical report presents an algorithm which implements the form (Shape) discrimination task performed by a model of the human visual system. This task is important because there is no known method by which the suitability of a symbol set can be evaluated without conducting expensive and time consuming psychophysical tests. The algorithm reported herein is a PREdictor of Visual Performance (PREVIP) at visual discrimination tasks. PREVIP is also used to display the results of the spatial frequency filtering performed by the model and to test the modeling of new tasks. PREVIP accepts a digital representation of a set of visual stimuli and applies a pre-programmed visual response filter. PREVIP then uses these filter outputs to compare the stimuli against a set of previously defined prototypes. This procedure generates a distance metric upon which visual discrimination errors are predicted or against which human errors can be correlated. PREVIP can also be used to test new visual prediction tasks and visual model improvements. Improvements to be included in future versions of PREVIP are: stimulus contrast and illumination effects, masking phenomena, and peripheral visual tasks. GRA

N81-18643# Michigan State Univ., East Lansing. Dept. of Biomechanics.
A FOUNDATION FOR SYSTEMS ANTHROPOMETRY Final Report
Herbert M. Reynolds, Jeff Marcus, James Freeman, and Laurie Batzer 25 Nov. 1980 22 p refs
(Contract F49620-78-C-0012; AF Proj. 2313)
(AD-A094395; AFOSR-81-0086TR) Avail: NTIS HC A02/MF A01 CSCL 06/14

System Anthropometry has laid the foundation for a three dimensional anthropometry. A unique, dedicated laboratory has been built and is currently used in an investigation of the lumbar/pelvic/femur linkage system. Data have been analyzed describing the three dimensional seated posture of 281 young female subjects. Through the use of a multivariant clustering procedure, two postures were identified: slouched and erect. Data have been collected and analyzed on the sacroiliac and hip joint motion in three dimensional space. Thus, the basis for describing in three dimensional space a fixed body posture and for obtaining data on joint mobility (the anatomical site at which a change of posture is made) has been established. GRA

N81-18644# Enviro Control, Inc., Rockville, Md.
BIOLOGICAL EFFECTS OF SHORT, HIGH-LEVEL EXPOSURE TO GASES: AMMONIA Phase Report, May 1979 - May 1980
Llewellyn J. Legters May 1980 87 p refs
(Contract DAMD17-79-C-9086; DA Proj. 3E1-62777-A-846)
(AD-A094501) Avail: NTIS HC A05/MF A01 CSCL 06/20

This report presents an analysis and synthesis of the available literature concerned with possible health and performance effects of exposures to ammonia. The US Army's concern is with short, high level exposures that may exceed present threshold limit values of the American Conference of Governmental Industrial Hygienists (25 ppm or 17 mg/cum as a TWA and a ceiling of 35 ppm or 24 mg/cum for 15 minutes). The organs primarily affected by exposure to ammonia gas are the respiratory tract and the eyes. During brief exposures to concentrations of 500 ppm (348 mg/cum) or less, the biologic responses are immediate, reversible, and mainly irritant. Below 50 ppm (35 mg/cum), there are no significant effects except that the odor of ammonia is detectable. Between 50-100 ppm (35-70 mg/cum), most people experience some degree of irritation of the eyes, nose and throat. There is some evidence indicating that personnel may become acclimated to the irritant effects after only 1 or 2 weeks of intermittent exposure at these levels. Around 130 ppm (90 mg/cum), approximately half of exposed personnel experience lacrimation. Lacrimation has been reported in subjects inhaling 500 ppm (348 mg/cum) of ammonia via face mask, which should have prevented direct contact of ammonia with the eyes. GRA

N81-18645# Enviro Control, Inc., Rockville, Md.
BIOLOGICAL EFFECTS OF SHORT, HIGH-LEVEL EXPOSURE TO GASES: NITROGEN OXIDES Phase Report, May 1979 - May 1980
John D. Morton Jul. 1980 95 p refs
(Contract DAMD17-79-C-9086; DA Proj. 3E1-63777-A-846)
(AD-A094502) Avail: NTIS HC A05/MF A01 CSCL 06/20

This report presents an analysis of the available literature describing the health and performance effects of exposure to nitrogen oxides (NOx). The US Army's concern is with high level, short term exposures that may exceed present threshold limit values of the American Conference of Governmental Industrial Hygienists: 5 ppm (9 mg/cum) as a TWA; intended changes are a TWA of 3 ppm (5.4 mg/cum) with a short term exposure limit of 5 ppm (9 mg/cum) for 15 minutes. Dose-response relationships were developed for intensities of exposure from the highest (fatal) level to thresholds of minimal response. It is concluded that NOx can in general be equated to nitrogen dioxide (NO2) because this is much more toxic than the only other oxide of importance, nitric oxide (NO), which oxidizes to NO2 in air. If NO is present in equal or greater concentration, an allowance for its effect is recommended. NO2 exhibits mainly two sets of toxicological characteristics: immediate irritancy and delayed, cumulative tissue damage. Proven effects are mainly on the respiratory tract. Intense exposures result in death, hospitalization with recovery, or severe responses not requiring hospitalization. Survivors may be free from permanent effects. This range covers concentrations from 20 ppm (38 mg/cum) to 200 ppm (376 mg/cum) and up, for single exposures of a few minutes up to 1 hour. GRA

N81-18646# Enviro Control, Inc., Rockville, Md.
BIOLOGICAL EFFECTS OF SHORT, HIGH-LEVEL EXPOSURE TO GASES: AMMONIA, CARBON MONOXIDE, SULFUR DIOXIDE, AND NITROGEN OXIDES Final Summary Report, 1 Jun. 1979 - 15 Aug. 1980
Llewellyn J. Legters, Thomas E. Nightingale, M. Janet Normandy, and John D. Morton Jun. 1980 31 p refs
(Contract DAMD17-79-C-9086; DA Proj. 3E1-62777-A-846)
(AD-A094505) Avail: NTIS HC A03/MF A01 CSCL 06/20

This project addressed the exposure of soldiers to toxic gases for periods of less than one hour and at concentrations above occupational exposure standards, with repetition up to six times per day for 14 days. Sources of the four gases are primarily propellant fumes and engine exhaust. Measurements have shown physiologically significant exposures to carbon monoxide and ammonia. Literature reviews and critical evaluations developed acceptable data bases on the types of biologic effects to be expected and on quantitative relationships between exposure level and intensity of response. These were interpreted in the context of the military exposure scenario and exposure criteria were suggested. Information gaps were identified and suggestions were made for further research. GRA

N81-18647# Enviro Control, Inc., Rockville, Md.
BIOLOGICAL EFFECTS OF SHORT, HIGH-LEVEL EXPOSURE TO GASES: SULFUR DIOXIDE Phase Report, May 1979 - May 1980
Mary Janet Normandy, Philip Szlyk, and Brenda Brienza May 1980 176 p refs
(Contract DAMD17-79-C-9086; DA Proj. 3E1-62777-A-846)
(AD-A094504) Avail: NTIS HC A09/MF A01 CSCL 06/20

This report presents an analysis and synthesis of the available literature concerned with possible health effects of exposures to sulfur dioxide. The U.S. Army is concerned with short, high level exposures to sulfur dioxide that may exceed present threshold limit values of the American Conference of Governmental Industrial Hygienists (5 ppm, 13 mg/cu m as a time-weighted average). The organ systems primarily affected by exposure to sulfur dioxide are the respiratory tract and the eyes. Certain neurologic effects (including suppression of dark adaptation and decreased light sensitivity) are of unknown significance and warrant further study. Below about 5 ppm, there are no significant irritant or pulmonary effects. Between 5 and 8 ppm (13 and 20.8 mg/cu m), most people will experience coughing, moderate irritation of the eyes, nose, and throat, and bronchoconstriction. At about 10 ppm (26 mg/cu m), moderate to severe eye irritation, copious lacrimation, and nasal and chest irritation will occur. At 20 to 30 ppm (52 to 78 mg/cu m), intense lacrimation, respiratory tract irritation, bronchoconstriction, epistaxis, sneezing, coughing, and hemoptysis may occur. With nasal breathing, about 99% of inspired sulfur dioxide is absorbed by the nasal mucosa and only 1% penetrates the lower airways. With mouth breathing, the effects of sulfur dioxide at a given concentration may be intensified. GRA

N81-18648# Army Research Inst. of Environmental Medicine, Natick, Mass.
USE OF A WETTED COVER TO REDUCE HEAT STRESS IN IMPERMEABLE CLOTHING
John R. Breckenridge Oct. 1980 38 p refs
(DA Proj. 3E7-6277-A-845)
(AD-A094322; USARIEM-T-7/80) Avail: NTIS HC A03/MF A01 CSCL 06/19

A mathematical model based on physical relations for heat exchange between clothed man and his environment has been developed which describes the cooling effect of a wet cover worn over an impermeable ensemble, in terms of the ensemble characteristics and the ambient environment. The model has been validated at low air movement for one such ensemble by comparing predictions of increased skin heat loss and cover evaporation with values obtained using an electrically heated copper mannikin dressed in the ensemble, with the cover both dry and wetted. The model predicts for this ensemble supplementary cooling (increased skin heat loss) ranging from 40 watts at 35 C, 70% relative humidity, and low air movement to almost 200 watts for a hot/dry environment of 50 C, 20% r.h., with 5 meters/second wind. Predicted water requirements to maintain the cover wet under these conditions range from 0.2 kilograms/hr to 1.9 kilograms/hr. The model also reveals that the wet cover would reduce the heat load imposed on a man by sunlight by 20 to 40 watts in full sun, but with a 0.2 to 0.3 kilograms/hr increase in water requirements. GRA

N81-18649# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
EFFECTS OF LONG-TERM EXPOSURE TO LOW LEVELS OF OZONE: A REVIEW
C. E. Melton Sep. 1980 17 p refs
(AD-A094426; FAA-AM-80-16) Avail: NTIS HC A02/MF A01 CSCL 06/20

Available literature regarding long term effects of ozone on animals and humans is reviewed. Emphasis is placed on reports that have appeared since 1976, but some earlier reports are cited for completeness and perspective. This review shows that ozone concentration is more important than is duration of exposure in determining the effectiveness of an ozone exposure (dose). This conclusion calls into question the validity of the Time-Weighted Average (TWA) as an index of severity of ozone exposure. The literature review further reveals that there is wide variation in susceptibility of different animal species to ozone, making it difficult to apply results of animal experiments to humans. It further appears that a dose of ozone that is acutely innocuous is also innocuous over the long term. The effects of a symptom-producing dose of ozone are initially cumulative for the first two or three exposures, then an adaptive response may ensue that involves a plateau of response or even a reversal. These effects are shown by both animals and humans. The mechanisms are unknown. Ozone probably causes damage by free radical formation. Free radical scavengers such as vitamins E and C may provide protection against ozone damage. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N81-18650*# California Univ., Davis.
PRELIMINARY REPORT ON SMALL GROUP FACTORS IN LONG DURATION SPACE FLIGHTS: REVIEW AND DIRECTIONS FOR FUTURE RESEARCH
Albert A. Harrison Sep. 1979 54 p refs
(Contract NCA2-OR180-803)
(NASA-CR-152385) Avail: NTIS HC A04/MF A01 CSCL 05I

Group dynamics, sociological and psychological factors are examined. Crew composition and compatability are studied. Group dynamics analysis includes: leadership; cohesiveness; conformity; and conflict. S.F.

N81-18651*# Santa Clara Univ., Calif.
PERFORMANCE CONSIDERATIONS IN LONG-TERM SPACEFLIGHT
Faren R. Akins Sep. 1979 93 p refs
(Contract NCA2-OR685-805)
(NASA-CR-152384) Avail: NTIS HC A05/MF A01 CSCL 05I

Maintenance of skilled performance during extended space flight is of critical importance to both the health and safety of crew members and to the overall success of mission goals. An examination of long term effects and performance requirements is therefore a factor of immense importance to the planning of future missions. Factors that were investigated include: definition of performance categories to be investigated; methods for assessing and predicting performance levels; in-flight factors which can affect performance; and factors pertinent to the maintenance of skilled performance. T.M.

N81-18652*# Santa Clara Univ., Calif.
PRELIMINARY REPORT: ISSUES IN SELECTION AND TRAINING FOR LONG DURATION SPACE FLIGHT
Faren R. Akins Oct. 1979 94 p refs
(Contract NCA2-OR180-805)
(NASA-CR-152386) Avail: NTIS HC A05/MF A01 CSCL 05I

Based on previous experience with crew selection, three important avenues of consideration for future missions are discussed: technical qualifications and expertise; medical fitness and ability to tolerate the various conditions of space; and psychological considerations including personality structure, motivation, intelligence, leadership potential, group compatibility, etc. Primary emphasis was given to the psychological considerations. T.M.

N81-18653*# California Univ., Davis.
PRELIMINARY REPORT ON SOCIAL PSYCHOLOGICAL FACTORS IN LONG DURATION SPACE FLIGHTS: REVIEW AND DIRECTIONS FOR FUTURE RESEARCH
Albert A. Harrison Sep. 1978 99 p refs
(Contract NCA2-OR180-803)
(NASA-CR-152382) Avail: NTIS HC A05/MF A01 CSCL 05I

Group dynamics, sociological and psychological factors are examined. Crew composition and compatibility are studied. Group dynamics analysis includes: leadership; cohesiveness; conformity; and conflict. S.F.

N81-18654# RAND Corp., Santa Monica, Calif.
PERFORMANCE MODELS FOR SPATIAL AND LOCATIONAL COGNITION Final Report, Oct. 1977 - Sep. 1980
Perry W. Thorndyke, Barbara Hayes-Roth, and Cathleen Stasz Dec. 1980 37 p refs
(Contract N00014-78-C-0042; NR Proj. 157-410)
(AD-A094149; RAND/R-2676-ONR) Avail: NTIS HC A03/MF A01 CSCL 08/2

Summarizes a three year investigation of the knowledge and processes people use to learn and make spatial judgments in large scale environments. Experiments in map learning indicated that both the use of effective study procedures and visual memory ability determine success at learning a map. All but low ability people benefit from training in effective study procedures. Studies of people's procedures for accuracy at estimating distances on maps indicated that map clutter increases subjective distance between two points. A third series of studies investigated differences in the knowledge people acquire from navigation and from map learning. Studying a map leads to a global representation of the environment, while navigation provides a linear, or procedural representation. Navigation experience is optimal for estimating route distances and orienting oneself toward unseen locations. Map learning is optimal for estimating the shortest distance between two points and determining relative locations of objects. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-18655*# Umpqua Research Co., Myrtle Creek, Ore.
DESIGN AND FABRICATION OF A FOUR-MAN CAPACITY URINE WICK EVAPORATOR SYSTEM Final Report
1 Nov. 1979 38 p
(Contract NAS2-9677)
(NASA-CR-152226) Avail: NTIS HC A03/MF A01 CSCL 06K

The integrated system was tested to determine the performance characteristics and limitations of the dual catalyst concept. The primary objective of the dual catalyst concept is to remove ammonia and other noxious substances in the gas phase and thereby eliminate the need for and current practice of chemically or electrochemically pretreating urine prior to distillation. T.M.

N81-18656*# Life Systems, Inc., Cleveland, Ohio.
FAULT DIAGNOSTIC INSTRUMENTATION DESIGN FOR ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEMS Final Report
P. Y. Yang, K. C. You, R. A. Wynveen, and J. D. Powell, Jr. Oct. 1979 63 p refs
(Contract NAS2-10050)
(NASA-CR-152309; LSI-TR-361-5) Avail: NTIS HC A04/MF A01 CSCL 06K

As a development phase moves toward flight hardware, the system availability becomes an important design aspect which requires high reliability and maintainability. As part of continous development efforts, a program to evaluate, design, and demonstrate advanced instrumentation fault diagnostics was successfully completed. Fault tolerance designs for reliability and other instrumenation capabilities to increase maintainability were evaluated and studied. T.M.

N81-18657*# National Aeronautics and Space Administration, Washington, D. C.
NUTRITION DURING LONG FLIGHT
A. S. Ushakov Oct. 1980 7 p refs Transl. into ENGLISH from Zdorovye (USSR), no. 4(304), 1980 p 4-5 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76436) Avail: NTIS HC A02/MF A01 CSCL 06K

The nutrition of astronautics during long flights is discussed, especially with respect to the changes brought about in the body by the condition of weightlessness. Author

N81-18658*# National Aeronautics and Space Administration, Washington, D. C.
WORK OF THE COSMONAUT
L. S. Demin Oct. 1980 12 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), Feb. 1977 p 4-9 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76437) Avail: NTIS HC A02/MF A01 CSCL 05H

The necessity for the cosmonaut to receive broad training in many fields in order to carry out his multifaceted work is discussed. The work includes: scientific research, engineering, operator's work, participation in technical commissions and councils, training on simulators, and the study of technology and sports. T.M.

N81-18659*# University of Southern California, Los Angeles.
DSN HUMAN FACTORS PROJECT Final Report
Roy L. Chafin and Thomas H. Martin 1 Nov. 1980 131 p refs
(Contracts NAS7-100; JPL-955013)
Avail: NTIS HC A07/MF A01 CSCL 05E

The project plan was to hold focus groups to identify the factors influencing the ease of use characteristics of software and to bond the problem. A questionnaire survey was conducted to evaluate those factors which were more appropriately measured with that method. The performance oriented factors were analyzed and relationships hypothesized. The hypotheses were put to test in the experimental phase of the project. In summary, the initial analysis indicates that there is an initial performance effect favoring computer controlled dialogue but the advantage fades fast as operators become experienced. The user documentation style is seen to have a significant effect on performance. The menu and prompt command formats are preferred by inexperienced operators. The short form mnemonic is least favored. There is no clear best command format but the short form mnemonic is clearly the worst. E.D.K.

N81-18660*# Hamilton Standard, Windsor Locks, Conn.
BREADBOARD SOLID AMINE WATER DESORBED CO2 CONTROL SYSTEM Test Report, 1 Sep. 1979 - 30 Jun. 1980
Arthur K. Colling and Mark M. Hultman Nov. 1980 59 p refs
(Contract NAS9-13624)
(NASA-CR-160917; SVHSER-7226) Avail: NTIS HC A04/MF A01 CSCL 06K

A regenerable CO2 removal system was developed for potential use on the shuttle as an alternate to the baseline lithium hydroxide (LiOH) system. It uses a solid amine material to adsorb CO2 from the atmosphere. The material is regenerated by heating it with steam from a zero gravity water evaporator. A full sized, thermally representative breadboard canister and a preprototype water evaporator were built and tested to shuttle requirements for CO2 control. The test program was utilized to evaluate and verify the operation and performance of these two primary components of the SAWD system. T.M.

N81-18661*# Hamilton Standard, Windsor Locks, Conn.
OPERATION AND MAINTENANCE MANUAL FOR A PREPROTOTYPE SABATIER CARBON DIOXIDE REDUCTION SUBSYSTEM
Gilbert N. Kleiner Jan. 1981 83 p refs
(Contract NAS9-15470)
(NASA-CR-160918; SVHSER-7222) Avail: NTIS HC A05/MF A01 CSCL 06K

The manual delineates the procedures, precautions and necessary sequences of steps required to prepare the package for test, provide troubleshooting information and perform required maintenance by the operating crew. The manual is divided into five sections: Installation, Checkout, Operation, Failure Detection/Isolation and Maintenance. T.M.

N81-18662*# Hamilton Standard, Windsor Locks, Conn.
DEVELOPMENT OF A PREPROTOTYPE SABATIER CO2

REDUCTION SUBSYSTEM
Gilbert N. Kleiner and Phillip Birbara Jan. 1981 171 p refs Revised
(Contract NAS9-15470)
(NASA-CR-160919; SVHSER-7221-Rev-A) Avail: NTIS HC A08/MF A01 CSCL 06K

A lightweight, quick starting reactor utilizes a highly active and physically durable methanation catalyst composed of ruthenium on alumina. The use of this improved catalyst permits a single straight through plug flow design with an average lean component H2/CO2 conversion efficiency of over 99% over a range of H2/CO2 molar ratios of 1.8 to 5 while operating with flows equivalent to a crew size of one person steadystate to 3 persons cyclical. The reactor requires no heater operation after start-up even during simulated 55 minute lightside/39 minute darkside orbital operation over the above range of molar ratios and crew loadings. Subsystem performance was proven by parametric testing and endurance testing over a wide range of crew sizes and metabolic loadings. The subsystem's operation and performance is controlled by a microprocessor and displayed on a nineteen inch multi-colored cathode ray tube. T.M.

N81-18663# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PILOT REACTIONS TO OPTICAL DEFECTS FOUND IN F-111 BIRD IMPACT RESISTANT WINDSCREENS Technical Report, Oct. 1978 - Sep. 1979
Shelton MacLeod and Robert G. Eggleston Dec. 1980 38 p refs
(AF Proj. 7184)
(AD-A093937; AFAMRL-TR-80-4) Avail: NTIS HC A03/MF A01 CSCL 05/5

A field study was conducted to assess the scope and severity of mission related optical problems associated with the new F-111 Bird Impact Resistant Transparency (BIRT) windscreen. Data for this study was gathered from an 81 item questionnaire and used to scale the opinions of 33 USAFE pilots. Principal findings indicate that: (1) distortion is perceived as the most disruptive optical factor followed in order by multiple images, haze and rainbowing; (2) the worst combination of optical defect and flight task is multiple images during night approach and landing; (3) the extent to which BIRT optical problems are perceived as impairing mission performance is sufficiently great to further justify research for improving windscreen optical quality. (4) pilots with very limited amounts of BIRT flying time (20-80 hours) are less likely to perceive windscreen optical problems than a middle experience group (with 100 to 180 flying hours). This difference is attributed to a lack of exposure to the optical effects; and (5) pilots with relatively extensive BIRT flying experience (over 200 hours) are also less prone to perceive windscreen problems than the middle experience group. This difference is attributed to the effect of a period of adjustment to the optical anomalies. GRA

N81-18664# Naval Postgraduate School, Monterey, Calif.
THE EFFECTS OF MULTIPLE ANTHROPOMETRIC CONSTRAINTS ON THE ACCOMMODATION OF PERSONNEL IN OPERATIONAL NAVAL AIRCRAFT M.S. Thesis
James Clayton Bartholomew Sep. 1980 121 p refs
(AD-A093626) Avail: NTIS HC A06/MF A01 CSCL 05/8

All Navy aircraft are required to accommodate, anthropometrically, ninety percent of the user population. Some designs have been criticized for their low accommodations but those accommodations have never been quantified. The purpose of this thesis was to quantify the accommodation, by each type of operational Naval aircraft, of populations of Naval aviation personnel of 1964, 1969, and 1975. The Computerized Accommodation Percentage Evaluation (CAPE) model was used to generate data points since only summary statistics were available for two of the populations. Each subject of every population was checked against the requirements of the design specification and against the limitations of each aircraft. All aircraft were found to accommodate more than ninety percent of the 1975 population. Time related changes in the populations were noted and unexplained inconsistencies in the data were discovered. Possible sources of error were discussed and potential solutions proposed. GRA

N81-18665# Illinois Univ. at Urbana-Champaign.
THE APPLICATION OF ADDITIVE FACTORS METHODOLOGY TO WORKLOAD ASSESSMENT IN A DYNAMIC SYSTEM MONITORING TASK Interim Technical Report
John Micalizzi and Christopher D. Wickens Dec. 1980 50 p refs
(Contract N00014-79-C-0658)
(AD-A094314; EPL-80-2/ONR-80-2) Avail: NTIS HC A03/MF A01 CSCL 05/8

This report describes the theory that lies behind applications of Sternberg's additive factors methodology to the selective assessment of primary task workload, within the framework of a multiple resources model of human information processing. In applying this methodology, a reaction time task is performed alone and concurrently with a primary task of interest. Orthogonally, a characteristic of the RT task is varied to prolong one stage of processing. If the effect of this manipulation is greater in the presence of the primary task than in its absence (i.e., an interaction), then the resource demands of the primary task are assumed to overlap with those imposed by the RT manipulation. If there is no interaction (additivity), then different resources are required. Conclusions of previous research efforts that have employed additive factors in dual task paradigms are summarized. A validation experiment is then reported in which a failure detection/monitoring task is employed as a primary task. Manipulations of perceptual and response load of a secondary reaction time task are performed while subjects engage in a primary task of monitoring for, and detecting failures of, an autopilot-controlled dynamic system. This primary task is assumed to place heavy demands on the earlier stages of processing. GRA

N81-18666# Perceptronics, Inc., Woodland Hills, Calif.
MAN-MACHINE COMMUNICATION IN REMOTE MANIPULATION TASK-ORIENTED SUPERVISORY COMMAND LANGUAGE (TOSC) Final Technical Report, 2 Feb. 1979 - 1 Feb. 1980
Yee-Yeen Chu, William H. Crooks, and Amos Freedy Mar. 1980 226 p refs
(Contract N00014-76-C-0603; NR Proj. 196-140)
(AD-A094482; PFTR-1034-80-3) Avail: NTIS HC A11/MF A01 CSCL 05/8

This report covers research and development directed toward the investigation and optimization of man-machine communication in computer aided remote manipulation. The purpose of this program was to determine through analytical and experimental studies the relationships between primary man-machine communication factors and system performance and to develop and demonstrate a communication design methodology to improve operator performance with remotely controlled systems. Specific objectives included the following: (1) to perform an analysis of communications requirements in computer aided manipulation and closely related areas of adaptive and autonomous control, (2) to establish an experimental system for study of task oriented supervisory control of a remote manipulator, (3) to implement and evaluate communication systems, encompassing both language and interface, designed to permit natural and efficient control of a variety of remote manipulation tasks, (4) to identify the primary factors influencing the success of shared man-computer control, and to establish quantitative relationships between these factors and the system performance measures, and (5) to provide guidelines for the design of man-computer communication in subsequent autonomous, adaptive and remotely manned systems. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N81-18667 Carnegie-Mellon Univ., Pittsburgh, Pa.
***PERFORMANCE EVALUATION OF A MULTIPROCESSOR UNDER INTERACTIVE WORKLOADS* Ph.D. Thesis**
Patrick Fabian McGehearty 1980 200 p *refs*
Avail: Univ. Microfilms Order No. 810618

The performance of a symmetrical multiprocessor in a conventional interactive environment is studied. Measurements are made of the multiprocessor, C.mmp, running under the operating system Hydra over a variety of workloads. The workloads are synthetic, but based on typical workloads found on existing interactive systems. A detailed simulation model of C.mmp/Hydra is developed and validated for the above measurements. The model is used to study a wider range of possible systems than can be examined directly with the available hardware/software configurations. Results based on both measurements and models are presented that apply to the class of symmetrical multiprocessors on the following issues: (1) the relationship between the number of processors and the level of hardware and software contention; (2) the effect of system paging bandwidth on system performance; (3) the amount of primary memory needed to achieve given levels of performance. Particular emphasis is given to examining the effect of varying the number of processors in the system on these results. Performance results specific to C.mmp/Hydra including specific overheads and anomalies are also discussed. Dissert. Abstr.

N81-18668 Connecticut Univ., Storrs.
***MATRIX OPERATIONS AND TRANSFORM TECHNIQUES* WITH A MULTIPROCESSOR SYSTEM FOR IMAGE PROCESSING AND PATTERN RECOGNITION Ph.D. Thesis**
David Francis Naccarato 1980 139 p
Avail: Univ. Microfilms Order No. 8103211

Multiprocessor algorithms are developed for global operations on large two dimensional arrays. These operations, which are used extensively in pattern recognition and image processing work are matrix multiplication, matrix inversion and various picture transforms. A model of a multiprocessor system for image processing and pattern recognition (MIPPR) is proposed and is analyzed using queueing theory techniques. Algorithms for array operations are designed to take advantage of a MIPPR type of environment. An algorithm is given for directly computing a two dimensional Fast Fourier Transform. The algorithm makes use of recursion by obtaining the transform of an array from transforms of its subarrays. This procedure is extended to methods for computing other direct two dimensional fast transforms.
Dissert. Abstr.

N81-18669 State Univ. of New York at Stony Brook.
***COMPUTATIONS ON A CELLULAR LOGIC ARRAY PROCESSOR* Ph.D. Thesis**
Yi-Shang Shen 1980 349 p
Avail: Univ. Microfilms Order No. 8101857

A set of definitions and theorems is developed which can be used as guidelines in designing stable programmable two dimensional cellular logic array processing (CLA). A CLA architecture is proposed which can be programmed to realize almost all the commonly used bulk data processing functions at remarkable speed. The general performance of the CLA is analyzed. The speed gain for each CLA application as compared with the best known algorithms in serial computers for the same task is evaluated. Since the CLA can be functioning cooperatively and in parallel with its supervisor (a conventional CPU), quite often completely new parallel computation algorithms must be implemented in order to achieve the maximum efficiency. The CLA processor performance related issues discussed include the construction and analysis of effective CLA parallel computation algorithms, the supervisor's role in supporting CLA computations, and language and operating system structures which provide efficient user interface with the CLA processor. Possible solutions to these issues are given. Dissert. Abstr.

N81-18670 Cornell Univ., Ithaca, N. Y.
AN ANALYSIS OF THE LOAD LEVELLING PROBLEM ***Ph.D. Thesis***
Ann M. Kratzer 1980 54 p
Avail: Univ. Microfilms Order No. 8102990

A model of the CPU load leveling problem is developed. The model defines both the input to a load leveling algorithm, the cost to execute each user job on each machine and a class of objective functions. The load leveling problem is stated as a minimization problem, i.e., the optimal assignments of users to machines is the one with lowest cost. The user costs are assumed to measure the amount of the computing resource required to execute the user task; thus, these costs can measure execution time, cost, etc. For a given assignment of users to machines, the objective function maps the user costs to a value that gives the overall cost of the assignment. It is then shown that the CPU load leveling problem is NP Complete. A decentralized load leveling algorithm for a subclass of CPU load leveling problems is examined. This algorithm requires as input all the user costs. In distributed computer systems, all the user costs would not generally be stored at one machine but would be distributed across the system. This decentralized algorithm successively optimizes the assignment of users to machines in some subset of the machines with size at least two and no more than m-1 where m is the total number of machines in system (all optimizations use the same subset size). Dissert. Abstr.

N81-18671 Stevens Inst. of Tech., Hoboken, N. J.
***THE FUNCTIONAL DECOMPOSITION OF AN OPERATING SYSTEM FOR OFF-LOADING ONTO PERIPHERAL PROCESSORS* Ph.D. Thesis**
Anita Johanna LaSalle 1980 244 p
Avail: Univ. Microfilms Order No. 8100855

It is demonstrated that improvements can be made in computing system performance if the operating system is off loaded onto peripheral (micro)processors. To most effectively off load, it is desirable to predict the collection of functions of the operating system which will be used by executing tasks and then insure that these groups of functions are resident at peripheral processors at the time the functions are needed. The technique used to ascertain functional execution sequences involved breaking up an operating system using interval decomposition and then running various workloads while probing the operating system in order to identify interval execution sequences. The interval sequences are likely candidates for off loading. Beginning with a complex operating system and using its real hardware environment to validate experimental results, it was shown how a complex system could be decomposed for assignment to separate processors. A simulation model of the proposed system was implemented which could be validated by the real system's performance. It was shown that off loading an operating system onto peripheral processors can appreciably improve the performance of a system particularly where parallelism is introduced.
Dissert. Abstr.

N81-18672*# National Aeronautics and Space Administration, Washington, D. C.
JOB BUILDER REMOTE BATCH PROCESSING SUBSYSTEM
I. G. Orlov and T. L. Orlova Jul. 1980 16 p Transl. into *ENGLISH of "Posistema distantsionnoy paketnoy obrabotki JOB* BUILDER" Rept. Pr-438 Moscow, 1978 15 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep.

by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-76251) Avail: NTIS HC A02/MF A01 CSCL 09B

The functions of the JOB BUILDER remote batch processing subsystem are described. Instructions are given for using it as a component of a display system developed by personnel of the *System Programming Laboratory, Institute of Space Research,* USSR Academy of Sciences. Author

N81-18673*# National Aeronautics and Space Administration, Washington, D. C.
LINKING OF THE BENSON GRAPH-PLOTTER WITH THE ELEKTRONIKA-1001 COMPUTER
I. Ye. Valtts, N. Ya. Nilolaev, M. V. Popov, and V. A. Soglasnov Sep. 1980 16 p Transl. into ENGLISH of "Sopryazhenie grafopostroitelya BENSON s EVM Elektronika-1001" Rept. Pr-448 Moscow, 1978 17 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-76182) Avail: NTIS HC A02/MF A01 CSCL 09B

A device, developed by the Institute of Space Research of *the Academy of Sciences of the USSR, for linking the Elektronika-*1001 computer with the BENSON graph-plotter is described. Programs are compiled which provide display of graphic and *alphanumeric information. Instructions for their utilization are* given. Author

N81-18674*# *National Aeronautics and Space Administration,* Washington, D. C.
DATA PROCESSING SYSTEM FOR THE SNEG-2MP EXPERIMENT
Ye. A. Gavrilova Jul. 1980 19 p Transl. into ENGLISH of "Sistema obrabotki dannykh eksperimenta Sneg-2MP" Rept. *Pr-380 Moscow, 1977 13 p Transl. by Kanner (Leo) Associates* Redwood, City, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3199)
(NASA-TM-76206) Avail: NTIS HC A02/MF A01 CSCL 09B

The data processing system for scientific experiments on stations of the 'Prognoz' type provides for the processing sequence to be broken down into a number of consecutive stages: *preliminary processing, primary processing, secondary processing.* The tasks of each data processing stage are examined for an experiment designed to study gamma flashes of galactic origin and solar flares lasting from several minutes to seconds in the 20 kev to 1000 kev energy range. A.R.H.

N81-18675*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FAULT-TOLERANT COMPUTER STUDY Final Report
D. A. Rennels, Algirdas A. Avizienis, and Milos D. Ercegovac 1 Feb. 1981 238 p refs Sponsored in part by Navy
(Contract NAS7-100)
(NASA-CR-163986; JPL-Pub-80-73) Avail: NTIS HC A11/MF A01 CSCL 09B

A set of building block circuits is described which can be used with commercially available microprocessors and memories to implement fault tolerant distributed computer systems. Each *building block circuit is intended for VLSI implementation as a* single chip. Several building blocks and associated processor and memory chips form a self checking computer module with *self contained input output and interfaces to redundant com-*munications buses. Fault tolerance is achieved by connecting self checking computer modules into a redundant network in *which backup buses and computer modules are provided to* circumvent failures. The requirements and design methodology which led to the definition of the building block circuits are *discussed.* M.G.

N81-18676# Engins Matra, Velizy (France). Div. Espace.
RANDOM ACCESS MEMORIES (RAM): THE DIFFERENT TYPES AND THE PROBLEM WITH ALPHA PARTICLES [LES MEMOIRES A ACCESS ALEATOIRE (RAM): LES DIFFERENTS TYPES ET LE PROBLEME LIE AUX PARTICULES ALPHA]
E. Rabeyrin, ed. 16 Apr. 1980 20 p In FRENCH
(DX-70/0.147) Avail: NTIS HC A02/MF A01

The two families of random access memories on the market *differ in their memorization modes and are distinguished as static* and dynamic memories. Both families can be fabricated according to metal oxide semiconductor or bipolar technologies. The different *operating modes (writing, reading, and storing) of random access* memories are described. Alpha particles emitted by uranium or thorium traces in the packaging near the semiconductor cause *soft errors or temporary failures which must be eliminated. The* effect of these particles on the semiconductors and on the integrated circuits is examined. Transl. by A.R.H.

N81-18677# Engins Matra, Velizy (France). Div. Espace.
BUBBLE MEMORY. PROGRESS REPORT 2. TEST AND RELIABILITY Progress Report [MEMOIRES A BULLES. RAPPORT D'AVANCEMENT. 2. TEST ET FIABILITE]
E. Rabeyrin 27 Aug. 1980 19 p In FRENCH
(DX-70/0.421-Pt-2) Avail: NTIS HC A02/MF A01

Both quality and reliability are fundamental requirements for *the proper operation of bubble memories. Problems related to* the identification of the important parameters of bubble memories are discussed as well as existing methods for estimating their *service life. Accelerated life tests being conducted on the Intel* 7110 1 megabit system are described. Transl. by A.R.H.

N81-18678# *Ohio State Univ., Columbus. Computer and* Information Science Research Center.
DESIGN AND ANALYSIS OF UPDATE MECHANISMS OF *A DATABASE COMPUTER (DBC)*
David K. Hsiao and M. Jaishankar Menon Jun. 1980 135 p refs
(Contract N00014-75-C-0573)
(AD-A094408; OSU-CISRC-TR-80-3) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report shows how the process of update is carried out in the database computer (DBC) which is a specialized back-end database machine capable of managing data of 10 to the 10 *power bytes in size. Since DBC might often have to be used in* an update-intensive environment (that is, an environment where many update, delete and insert commands and only a few retrieve *commands are issued), we have indicated throughout this report* the kind of architectural enhancements which will provide good performance in an update-intensive environment. Perhaps the *most important enhancement that affects the performance of all* the four types of requests in DBC (retrieve, delete, insert and update) is the incorporation of a track-size buffer with each TIP. *The advantages that accrue as a result of the incorporation are* clearly demonstrated in the various sections of the report. GRA

N81-18679# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A DESIGN STUDY FOR AN EASILY PROGRAMMABLE, *HIGH-SPEED PROCESSOR WITH A GENERAL-PURPOSE* ARCHITECTURE
Douglas B. Paul, Joel A. Feldman, and Vincent J. Sferrino 23 Oct. *1980 76 p refs*
(Contract F19628-80-C-0002; ARPA Order 3336)
(AD-A094064; TN-1980-50; ESD-TR-80-217) Avail: NTIS *HC A05/MF A01 CSCL 09/5*

A design study has been carried out for an easy-to-program high speed signal processor. The machine achieves a throughput *of about 25 million arithmetic operations per second by* incorporating parallel addressing and data access into a general-purpose architecture. The study indicates that, for typical signal *processing applications, nearly all of the instruction cycles can* be used to perform primary arithmetic operations rather than data access or addressing. The proposed machine would require *about 1165 ECL 100K chips, occupy 2-3 cubic feet, and* consume about 700 watts. GRA

N81-18680# *Royal Netherlands Meteorological Inst., De Bilt.* Oceanografisch Onderzoek.
DATA STORAGE FOR CTD AND XBT DATA [GEGEVENSOPSLAG VOOR CTD EN XBT GEGEVENS]
G. J. Prangsma 1980 25 p refs In DUTCH
(KNMI-V-338) Avail: NTIS HC A02/MF A01

An efficient method for the storage of CTD and XBT measuring data files is discussed. Three different file structures are suggested: (1) punch-tapes, (2) magnetic discs, and (3) magnetic tapes. Simple reading and writing procedures which can be utilized without the interference of a programmer/operator are emphasized. Data references have to be in such a form that they can be adapted to a semi-automatic system for international configuration exchange standards. Transl. by E.A.K.

N81-18681 *State Univ. of New York at Buffalo, Amherst.*
THE DESIGN AND EVALUATION OF AN ACTIVE MEMORY UNIT Ph.D. Thesis
Gabriel Mauricio Silberman 1980 166 p
Avail: Univ. Microfilms Order No. 8104239

The potentials of an active memory unit are explored. This unit is a computer module which provides, independent of the central processing unit (CPU), a one level memory space, subsumming in it all file I/O operations. In this context the new concept of delayed-staging hierarchies is introduced. They are a generalization of linear storage hierarchies consisting of additional paths connecting some directly to the CPU. It is proved that stack processing is applicable to this type of storage hierarchy, yielding an efficient algorithm for one-pass evaluation of several configurations. Also, a model for delayed staging, based on power functions for cost and fault ratios, is developed and solved using geometric programming. It results in a set of sizes and speeds for the storage levels which yields an optimal average access time under a given cost constraint. The thesis examines the implications upon system architecture and performance of having an active memory unit. It points out the reduction in size and complexity of an operating system which is assisted by an acting memory unit and the benefits for programming languages. Dissert. Abstr.

N81-18250# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A CORE MEMORY MANAGEMENT SYSTEM
Yves Gorge *In its* La Rech. Aerospatiale, Bimonthly Bull. No. 1980-2 (ESA-TT-562) 1980 p 73-77 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1980-2, Mar. - Apr. 1980 p 141-145 Original report in FRENCH previously announced as A80-46231 (For primary document see N81-18244 09-31)
Avail: NTIS HC A05/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-18682 California Univ., Los Angeles.
IDEA: AN ISSUE-DRIVEN ELICITATION ALGORITHM FOR DECISION PROBLEM STRUCTURING Ph.D. Thesis
Joseph Saleh 1980 148 p
Avail: Univ. Microfilms Order No. 8102873

A computerized, domain independent, decision support system which is based on an issue driven elicitation algorithm is described. The algorithm uses a goal directed structure for representing decision problems. The structure allows the user to state relations among aspects, effects, conditions, and goals, in addition to actions and states which are the basic components of the traditional decision tree approach. The program interacts with the user in a stylized English-like dialogue, starting with the stated objectives and proceeding to unravel the more detailed means by which these objectives can be realized. The disparity between the desire to accomplish an objective and the ability to do that establishes an issue. At any time, the program focuses the user's attention on the issues which are most crucial to the problem at hand. The structure used is highly compatible with the way people encode knowledge about problems and actions and, therefore, promises to offer the following: (1) judgments and beliefs issued by the user would constitute a valid representation of the user's experience, and (2) the user may be guided toward the discovery of action alternatives he otherwise would not have identified. Dissert. Abstr.

N81-18683 *California Univ., San Diego.*
COMPUTATION OF MATRIX CHAIN PRODUCTS Ph.D. Thesis
Man-Tak Shing 1980 145 p
Avail: Univ. Microfilms Order No. 8103794

The computation of matrix chain products of the form M *sub 1 x.M sub 2-x ... x M sub n-1 is studied. If the matrices* are of different dimensions, the order in which the matrices are computed affects the number of operations. An optimum order is an order which minimizes the total number of operations. Some theorems about an optimum order of computing the matrices *are presented. Based on these theorems, an O9(n) algorithm to* find a near optimum order of computation is developed. The order produced by the heuristic algorithm takes less than 1.155 *T sub opt, where T sub is the minimum number of operations* required to evaluate the matrix chain product. An O(n log n) algorithm for finding the optimum order of computation is also presented. Dissert. Abstr.

N81-18684 *Connecticut Univ., Storrs.*
OPTIMAL REALIZATION OF COMPUTATIONS IN A MULTIPROCESSING ENVIRONMENT Ph.D. Thesis
Shou-Chung Yang 1980 148 p
Avail: Univ. Microfilms Order No. 8103253

The development of structural parallelism is described, along with algorithms for transforming both the data flow and precedence flow of a computation into forms which maximize structural parallelism. Based on the consideration of data requirements, scheduling methods are developed for optimizing communication overhead. Also, evaluative criteria are developed and used to illustrate the application feasibility of the presented concepts. These results provide a designer methods of analysis that not only guide him in achieving optimal parallel forms for his computation, but also assess the potential run-time performance. The designer may then have a realistic idea of what might be accomplished and the analysis results may provide diagnostic data to aid the actual hardware/software system development. Dissert. Abstr.

N81-18685 California Univ., Los Angeles.
A WEIGHTED LINE-FINDING ALGORITHM Ph.D. Thesis
Karim Abdoshshah 1980 165 p
Avail: Univ. Microfilms Order No. 8102800

The problem of line detection and edge extraction in a digital image is addressed. An algorithm is defined that has the advantages of low noise sensitivity, low storage requirements, and capability of line texture definition. A statistical variable is also defined to evaluate the performance of the algorithm and to compare it with the Hough method. The algorithm can be applied to gray level images after extracting edges from a natural image. A smoothing technique that diminishes spurious noise present in the gray level images is described as well as a thinning method for attenuating redundant edges found after the O'Gorman's gradient method is applied on input images. Experimental analysis of noise effect on the independent variables of the image show that the algorithm has several advantages over the Hough algorithm. The new method is less sensitive to the noise effect on the dependent variables. Dissert. Abstr.

N81-18686 Cornell Univ., Ithaca, N. Y.
REVERSAL-BOUNDED COMPUTATIONS Ph.D. Thesis
Tat-Hung Chan 1980 162 p
Avail: Univ. Microfilms Order No. 8102940

In computations by abstract computing devices such as the Turing machine, head reversals are required for searching the input or retrieving intermediate results. Hence the number of head reversals is a measure of the complexity of a computation. Reversal-bounded computations on three models of abstract computing devices are studied. The first model is the 1-tape Turing machine with finite bounds on head reversals. The second model is the multicounter machine with general bounds on counter reversals. Lastly, finite reversal-bounded multitape finite automata are considered. Dissert. Abstr.

N81-18687 California Univ., Los Angeles.
DETECTING SOFTWARE ERRORS BEFORE EXECUTION Ph.D. Thesis
Paul Richard Eggert 1980 208 p

Avail: Univ. Microfilms Order No. 8103993

Strengthened types and other language design techniques can drastically simplify verification of desired runtime properties of computer programs. These techniques encourage a careful programming style, and a skeptical compiler can easily verify such programs against most runtime errors. An example from existing languages is that it is hard to prove PL/I programs free of mistyped pointers, but the same proof is simple in Pascal because its pointers are strongly typed: Pascal programmers must carefully write the types of all pointer addressed storage, and most Pascal compilers verify programs free of mistyped pointers. A Pascal variant, B-Pascal, is designed that permits compiletime detection of every error that is a runtime error in Pascal. For example, in B-Pascal subrange values are so strongly typed that a compiler can easily verify a program free of subscript errors. Alternatives to the design are explored and evaluated on the basis of security and efficiency. A standard for B-Pascal, in the style of the existing Pascal standard, is presented. An analysis is made of the difficulties of translating programs from Pascal to B-Pascal. Dissert. Abstr.

N81-18688 Stanford Univ., Calif.
CANONICAL LADDER FORM REALIZATIONS AND FAST ESTIMATION ALGORITHMS Ph.D. Thesis
Daniel Tai Lik Lee 1980 397 p
Avail: Univ. Microfilms Order No. 8103530

The study of the structure of canonical ladder realizations of systems and the associated estimation, control and signal processing algorithms is presented. A comprehensive and unified treatment of both the structural and algorithms aspects of ladder canonical forms is presented. In the context of the structure of linear systems, ladder forms are the most promising canonical forms for many classical linear systems problems. From an algorithmic point of view, ladder forms arise naturally in many least squares problems. One of the most important features of the ladder algorithms is the exact time update property, i.e., the recursions are obtained with the condition that at each new time step, the least squares criterion must be satisfied. Both stationary and nonstationary processes can be handled in a very elegant manner by the ladder forms, via the so called alpha-stationary embedding techniques. Dissert. Abstr.

N81-18689 Utah State Univ., Logan.
AN EXPERIMENTAL INVESTIGATION OF THE UTILITY OF STRUCTURED FLOWCHARTS IN STRUCTURED COBOL PROGRAMMING Ph.D. Thesis
Charles Martin Crittenden 1980 170 p
Avail: Univ. Microfilms Order No. 8104271

The utility of structured flowcharts in structured COBOL program composition, comprehension, debugging, and modification is evaluated. A significant difference between two sample groups of college students was noted in program composition. There were no significant differences in the number of walk-through errors, program comprehension, program debugging, or program modification. Structured flowcharts should not be stressed in programming classes nor should they be required for program documentation. Structured program coding is as easy or easier to read and to understand the logic of a program than is a structured flowchart. Dissert. Abstr.

N81-18690 Tennessee Univ., Knoxville.
COMPUTER STEREO VISION FOR THREE-DIMENSIONAL OBJECT LOCATION Ph.D. Thesis
Juin-Jet Hwang 1980 238 p
Avail: Univ. Microfilms Order No. 8104594

The theory of and algorithms for using computer stereo vision to locate three dimensional objects are presented. General equations for relating the corresponding image points in two different views are derived. Methods for computing the location of a three dimensional object with known and unknown camera models are described. Algorithms for image segmentation to extract image features such as regions, edge segments, and vertices are also developed. Both the geometric and the structural information are used to remove the ambiguous features from two views. The structural information of each view is stored in a relational table in which the features of regions, edge segments, and vertices are the primitive elements. A relaxation labelling process is employed to deduce two isomorphic relational tables in which only the consistent features of the two different views are stored. A matching line equation derived from the geometric relationships of two views is used as a constraint function in the relaxation labelling process. The corresponding points in the two views are found by searching along the consistent edge segments in two isomorphic tables using the matching line equation. Dissert. Abstr.

N81-18691 North Carolina Univ. at Chapel Hill.
THE ANTITHETIC SAMPLING METHOD: VARIANCE REDUCTION TECHNIQUE IN COMPUTER SIMULATION Ph.D. thesis
BaoSheng Douglas Huang 1980 194 p
Avail: Univ. Microfilms Order No. 8104393

The theory of antithetic sampling in the computer simulation is investigated. An antithetic sampling scheme generates a set of identically but not independently distributed random variables, such that the variance of the sample mean is smaller than that of independent sampling. This paper assumes that the random variable under study is generated from a uniform deviate by the inverse distribution method and that its second moment is finite. The first major result is the formation of the antithetic sampling problem into a special type of nonlinear programming problem. The second major result is the measurement of the efficiency of these two sampling schemes. Besides the use of the trapezoidal approximation argument, a generalized Euler-Maclaurin summation formula is used to estimate the variance of the sample mean. The efficiency of both antithetic sampling schemes depends on the smoothness of the inverse distribution function. It is shown that the degree of symmetry of the random variable affects the efficiency of the rotation reflection sampling scheme. A comparison of the efficiency of the antithetic sampling scheme for several commonly used random variables is presented. Tables of their variance reduction are computed. These tables show that a significant variance reduction is obtained by each of the sampling schemes. Dissert. Abstr.

N81-18692 George Washington Univ., Washington, D.C.
A UNIFIED NON-PROCEDURAL ENVIRONMENT FOR DESIGNING AND IMPLEMENTING GRAPHICAL INTERFACES TO RELATIONAL DATA BASE MANAGEMENT SYSTEMS Ph.D. Thesis
Michael Thomas Garrett 1980 177 p
Avail: Univ. Microfilms Order No. 8100332

Motivation is given for the integrated use of graphics and data base management systems. Some examples of existing systems with classes of this type are presented. Goals are identified, and related work which leads to these goals is discussed. After a brief discussion of data abstraction, a graphical structure suggested by the ACM SIGGRAPH Graphics Standards Planning Committee Core System is described. Some techniques for the decomposition of relations by link dependencies are used to create graphical structures which are efficient in storage and interpretation. Data bases for the handling of graphical input are then described. The relationships that exist between graphical and application information components are crucial and involve the use of integrity constraints, view definitions, and alerters. Inadequacies of these concepts are identified and necessary enhancements are presented. A specific production rule form is described in some detail. Dissert. Abstr.

N81-18693 Stanford Univ., Calif.
COMPUTATIONAL USES OF THE MANIPULATION OF FORMAL PROOFS Ph.D. Thesis
Christopher Alan Goad 1980 130 p
Avail: Univ. Microfilms Order No. 8103511

Computational uses of the additional information contained in proofs, and efficient methods for the representation and transformation of proofs are addressed. An extended lambda-calculus is presented which allows compact expression of the computationally significant part of the information contained in proofs. Terms of the calculus preserve depencency data, but can be efficiently executed by an interpreter of the kind used for lambda-calculus based languages such as LISP. The calculus has been implemented on the Sanford Artificial Intelligence Laboratory PDP-10 computer. Results of experiments on the use of pruning transformations in the specialization of a bin packing algorithm are reported. Dissert. Abstr.

N81-18694 Stanford Univ., Calif.
A DIALOGUE MODERATOR FOR PROGRAM SPECIFICATION DIALOGUES IN THE PSI SYSTEM Ph.D. Thesis
Louis Ira Steinberg 1980 162 p
Avail: Univ. Microfilms Order No. 8103565

A system to engage in a mixed topic initiative dialogue with the user (a dialogue where both parties can influence the order in which topics are covered) is described. The general ideas of initiative and structure in dialogues are discussed and connections between these ideas and those of expectations and speech acts are established. In discussing how a system can handle mixed initiative dialogue, the problems of choosing one question to ask (out of all those logically possible at a given time) and handling meta-dialogue (discussion during the dialogue about the structure of the dialogue) are considered. The PSI program synthesis system engages in a mixed initiative dialogue with a user who is specifying a program. The dialogue moderator (DM) is the module of PSI responsible for following and guiding the flow of topics in this dialogue and for helping discuss this topic flow with the user. DM chooses a question to ask by a process of rule-directed search on a network representing the structure of the dialogue. Dissert. Abstr.

N81-18695 Stanford Univ., Calif.
EXPRESSION PROCEDURES AND PROGRAM DERIVATION Ph.D. Thesis
William Louis Scherlis 1980 185 p
Avail: Univ. Microfilms Order No. 8103553

The derivation of programs by transformation techniques is investigated. By expanding an ordinary language of recursion equations to include a generalized procedure construct (the expression procedure), the ability to manipulate programs in that language is greatly facilitated. The expression procedure provides a means of expressing information not just about the properties of individual program elements, but also about the way they relate to each other. A set of three operations: abstraction, application, and composition, for transforming programs in this extended language is presented. The heuristic problems of program development are explored. A tactic of program specialization is shown to underlie many of these derivations. Consideration is given to issues related to the development of programming tools. The practical value of the approach is demonstrated in the systematic development of a partial family tree of parsing algorithms. Dissert. Abstr.

N81-18696 Stanford Univ., Calif.
AN EFFECTIVE COMPUTATIONAL APPROACH TO THE COMPREHENSION OF PURPOSEFUL ENGLISH DIALOGUE Ph.D. Thesis
Roger Clyde Parkison 1980 153 p
Avail: Univ. Microfilms Order No. 8103546

A natural language comprehension program is described which permits a person to communicate with a application program in ordinary English. There are no specific restrictions on the vocabulary or grammar which the person may use. The subject area of the application program provides a semantic context within which any input to the program is analyzed. The language comprehension program is a bottom-up analyzer which used a mixture of syntatic simplification and semantic rules to identify the underlying meaning of an English input. This program was used successfully as one component of a computer simulation of paranoia known as PARRY. Dissert. Abstr.

N81-18697 Stanford Univ., Calif.
VERIFYING CONCURRENT PROCESSES USING TEMPORAL LOGIC Ph.D. Thesis
Brent Tzion Hailpern 1980 217 p
Avail: Univ. Microfilms Order No. 8103516

A technique for the verification of parallel programs is stated in terms of axioms and inference rules, and is used to prove safety and liveness properties of parallel programs. Safety properties are assertions that must be satisfied by the system state at all times; they are analogous to partial correctness. Liveness properties refer to events that will occur in the future, such as program termination or the eventual receipt of a message. In addition to the formal proof rules, several heuristics are presented to aid in the preparation of correctness proofs. A parallel program is modeled as a set of interacting modules (processes and monitors) and this modularity is exploited in the verification process. This verification technique is applied to two classes of parallel programs; network protocols and resource allocators. Dissert. Abstr.

N81-18698 Rensselaer Polytechnic Inst., Troy, N. Y.
MODEL REFERENCE ADAPTIVE CONTROL FOR MULTI-INPUT MULTI-OUTPUT SYSTEMS Ph.D. Thesis
Kenneth M. Sobel 1980 229 p
Avail: Univ. Microfilms Order No. 8103764

Three adaptive model reference control algorithms for linear multi-input, multi-output systems are developed. These algorithms do not require either satisfaction of the perfect model following conditions or explicit parameter identification. The first algorithm for continuous plants ensures asymptotic stability of the output error provided that the output stabilized plant transfer matrix is strictly positive real. The second algorithm guarantees a bounded error under less restrictive conditions. The third algorithm ensures a bounded error for discrete plants provided constraints analogous to the second algorithm are satisfied. Since the algorithms do not require either satisfaction of the perfect model following conditions for full state feedback, they are applicable to a larger class of systems than previous algorithms. The sufficient conditions required to ensure stability of the adaptive algorithms include the satisfaction of certain matrix inequality constraints. Methods are proposed for satisfying these constraints; both in the time domain and in the frequency domain. Dissert. Abstr.

N81-18699 Syracuse Univ., N. Y.
AMPLE: A MULTI-PROGRAMMING LANGUAGE EXTENSION Ph.D. Thesis
Barry Clifford Goldstein 1980 172 p
Avail: Univ. Microfilms Order No. 8104527

An extension to APL (A Programming Language) is presented that addresses the problems faced in developing operating systems and complex data base systems. Language constructs are introduced, within the framework of APL, which provide solutions for the problems of multiprogramming, concurrent sharing of resources, security, integrity, and the general topic of recovery of both objects and programs. Extensions are made which allow for the establishment of effective third party controls. These mechanisms, which can be used to address the management of an abstract object (such as a data base), enable implicit control, so that the user of the object is unaware of that control. In general, the approach here is to break down the division between operating system and language and apply to operating system constructs the same type of approach typically given to languages. These constructs are included in a natural way in extended APL semantics, rather than using the classical layered approach, where distinct lines are drawn between the programming language, the operating system and the machine. With AMPLE (A Multi Programming Language Extension), the programming language, command language, and the machine language are unified. Dissert. Abstr.

N81-18700 Washington State Univ., Pullman.
DETERMINISTIC AND NONDETERMINISTIC FLOWCHART INTERPRETATIONS Ph.D. Thesis
Richard Joseph Lorentz 1980 60 p
Avail: Univ. Microfilms Order No. 8104141

Programming languages are studied in the abstract. Algebraic theories supply the syntax for programming languages. Semantics provided by coproduct preserving functors from the algebraic theory to some semantic category with finite coproducts. Deterministic programming languages are provided when the semantic domain is the category of pointed sets and point preserving functions. Nondeterministic programming languages occur when the semantic domain is the category of abelian monoids. The class of all nondeterminstic programming languages with a fixed syntax is shown to be a variety of algebras. All classes of deterministic programming languages shown to be non-varietal. Other properties of classes of programming languages are studied using category theory. Dissert. Abstr.

N81-18701 Utah State Univ., Logan.
VECTOR OPTIMIZATION DECISION CONVERGENCE ALGORITHM (VODCA) Ph.D. Thesis
Thomas Ward Morgan 1980 150 p

Avail: Univ. Microfilms Order No. 8104114

A methodology is described for the integration of a formal mathematical programming technique for generating the full range of feasible alternatives with a pragmatic group-interaction technique for extracting value information regarding alternatives. The integration results in an iterative group-interaction process which leads to successive reductions in the preferred range of alternatives until the most preferred alternative is identified. The methodology represents an improvement over other methodologies in two ares: (1) the noninferior set is explicitly identified insuring selection of a group decision point whch is noninferior, (2) a least squared error mathematical filtering technique is developed for smoothing relative value data obtained from the decision making body. In addition, a convergence proof is developed which not only indicates the theoretically sound and robust nature of the algorithm but in addition provides a basis for an improved class of algorithms for solving classical nonlinear constrained problems. The technique was developed for and implemented in an interactive software package. The multiobjective decision problem is solved in a single encounter with a cooperative decision making group. Dissert. Abstr.

N81-18702 Purdue Univ., Lafayette, Ind.
PROGRAMMING LANGUAGES AS ABSTRACT DATA TYPES: DEFINITION AND IMPLEMENTATION Ph.D. Thesis
Joseph Henry Fasel, III 1980 130 p
Avail: Univ. Microfilms Order No. 8102645

It is demonstrated that a uniformity of approach to both the definition and implementation of programming languages is obtained by regarding them as abstract data types; that is, as collections of operators. These operators include syntactic constructors, evaluators of expressions, and executors of programs. The algebraic specification of abstract data types is studied by means of sets of first-order equations involving the operators and universally quantified variables. Some results on the relative power of specification techniques are derived and the notion of an implementation of an algebraically specified data type is defined. The application of algebraic semantics to programming languages is investigated by defining a small language algebraically, and comparing this definition to Vienna, Scott-Strachey, and Floyd-Hoare definitions of the same language. A simple machine is defined as an abstract data type, and an algebraic treatment of an implementation of the programming language in terms of the machine is presented. Dissert. Abstr.

N81-18703*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN EVALUATION OF THE INTERACTIVE SOFTWARE INVOCATION SYSTEM (ISIS) FOR SOFTWARE DEVELOPMENT APPLICATIONS
Marie S. Noland Jan. 1981 31 p refs
(NASA-TM-81924) Avail: NTIS HC A03/MF A01 CSCL 09B

The Interactive Software Invocation System (ISIS), which allows a user to build, modify, control, and process a total flight software system without direct communications with the host computer, is described. This interactive data management system provides the user with a file manager, text editor, a tool invoker, and an Interactive Programming Language (IPL). The basic file design of ISIS is a five level hierarchical structure. The file manager controls this hierarchical file structure and permits the user to create, to save, to access, and to purge pages of information. The text editor is used to manipulate pages of text to be modified and the tool invoker allows the user to communicate with the host computer through a RUN file created by the user. The IPL is based on PASCAL and contains most of the statements found in a high-level programming language. In order to evaluate the effectiveness of the system as applied to a flight project, the collection of software components required to support the Annular Suspension and Pointing System (ASPS) flight project were integrated using ISIS. The ASPS software system and its integration into ISIS is described. M.G.

N81-18704# Tracor, Inc., Austin, Tex.
HYBRID PASSIVE TRACKING ALGORITHMS, EXECUTIVE SUMMARY
Glenn Corser 31 Oct. 1980 11 p refs
(AD-A093862) Avail: NTIS HC A02/MF A01 CSCL 17/1

For the fast several years Tracor has been conducting research on the performance and utility of a batch algorithm, used for underwater tracking with passive sonobuoys, called the Maximum Likelihood Procedure (MLP). To provide a means of comparison with the MLP and also in an attempt to gain insight into the applicability of sequential algorithms to underwater tracking, Tracor, in conjunction with Dr. Byron Tapley of the University of Texas, designed and implemented a sequential tracking algorithm based on the extended Kalman filter. After testing of the MLP and sequential algorithms revealed their complementary strengths, it was decided that a combination of the two approaches, or a hybrid algorithm should be developed. Thus, the primary objectives of this contract were to: implement a simpler, faster batch initializing procedure; implement numerically more stable sequential algorithm; devise more appropriate switching rules for going from batch to sequential and vice versa; and to streamline and generalize the program. GRA

N81-18705# Tracor, Inc., Austin, Tex.
HYBRID PASSIVE TRACKING ALGORITHMS Final Report
Glenn Corser and Thomas Wilson 31 Oct. 1980 125 p refs
(Contract N00014-78-C-0670)
(AD-A093867) Avail: NTIS HC A06/MF A01 CSCL 17/1

This report is concerned with the refinement and performance evaluation of a passive hybrid tracking algorithm. It is composed of a simplified batch filter and a numerically-stable extended Kalman filter, linked together by a set of statistically meaningful switching rules. Comparisons in performance between the hybrid, Tracor's MLP algorithm, and a sequential-sequential algorithm (where the batch initializer is replaced with an iterated extended Kalman Filter) are made using simulated data. GRA

N81-18706# Naval Civil Engineering Lab., Port Hueneme, Calif.
DECEL 1 USERS MANUAL A FORTRAN IV PROGRAM FOR COMPUTING THE STATIC DEFLECTIONS OF STRUCTURAL CABLE ARRAYS Final Report, Jun. 1979 - Jul. 1980
S. Sergev Aug. 1980 200 p refs
(AD-A093356; CEL-TN-1584) Avail: NTIS HC A09/MF A01 CSCL 13/13

DECEL-1 is a FORTRAN IV program for computing the ocean current-induced static deflections of undersea structural cable arrays. As dimensioned, the program can handle arbitrarily configured arrays of up to 22 cables. The cables can be electromechanical, wire rope, or synthetic. Any number of discrete devices (buoyancy elements, current meters, tensiometers, etc.) can be incorporated in the array. An option for parametric studies is included in the program, as in an option for incorporating arbitrary current fields. As written, DECEL-1 should be compatible on most FORTRAN IV compilers with Boolean algebra capabilities. GRA

N81-18707# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE APPLICATION OF TWO DIMENSIONAL MOMENT INVARIANTS TO IMAGE SIGNAL PROCESSING AND PATTERN RECOGNITION M.S. Thesis
Tyle T. Kanazawa Dec. 1980 153 p refs
(AD-A094440; AFIT/GEO/PH/80-7) Avail: NTIS HC A08/MF A01 CSCL 17/8

This thesis investigates the application of two dimensional moment invariants to image pattern recognition. The general problem studied is how to identify an aircraft target and its orientation in real time. The method of moment invariants provides a clever feature extraction technique to reduce the information in an image to a finite number of quantities which are translation, size, and rotation independent. GRA

N81-18708# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.
A COMPARATIVE EVALUATION OF STATISTICAL IMAGE SEGMENTATION TECHNIQUES
C. H. Chen 26 Jan. 1981 18 p refs
(Contract N00014-79-C-0494)
(AD-A094237; SMU-EE-TR-81-3) Avail: NTIS HC A02/MF A01 CSCL 09/2

Statistical image segmentation refers to the computer-oriented

procedures that partition the image into meaningful parts by using the statistical pattern recognition techniques. Although most image segmentation works have been nonstatistical in nature, there is now strong interest in the use of the supervised and the unsupervised classification techniques for image segmentation. In this paper, a critical comparison is made on the supervised image segmentation techniques including the Fisher's linear discriminant, the autoregressive moving-average modelling, the maximum likelihood region estimation, and the maximum a posteriori region estimation, as well as on the unsupervised image segmentation techniques including the cluster analysis, the estimation-theory based method, histogram directed segmentation techniques, and the decision-directed method using the conditional population mixture model. Some computer results are presented. The fundamental issues in the statistical image segmentation and the related topics are also reviewed. GRA

N81-18709# SRI International Corp., Menlo Park, Calif. Computer Science Lab.

A VERIFICATION CONDITION GENERATOR FOR FORTRAN

Robert S. Boyer and J. Strother Moore Jun. 1980 132 p refs

(Contract N00014-75-C-0816)

(AD-A094609; SRI/CSL-103) Avail: NTIS HC A07/MF A01 CSCL 12/1

This paper provides both a precise specification of a subset of FORTRAN 66 and FORTRAN 77 and a specification of the verification condition generator we have implemented for that subset. Our subset includes all the statements in FORTRAN 66 except the following: READ, WRITE, REWIND, BACKSPACE, ENDFILE, FORMAT, EQUIVALENCE, DATA, and BLOCK DATA. We place some restrictions on the remaining statements; however, our subset includes certain uses of COMMON, adjustable array dimensions, function subprograms, subroutine subprograms with side effects, and computed and assigned GO TOs. Unusual features of our system include a syntax checker that enforces all our syntactic restrictions on the language, the thorough analysis of aliasing, the generation of verification conditions to prove termination, and the generation of verification conditions to ensure against such run-time errors as array bound violations and arithmetic overflow. We have used the system to verify several running FORTRAN programs. We present one such program and discuss its verification. GRA

N81-18710# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

LINEARIZING NONLINEAR 0-1 PROGRAMS

Egon Balas and Joseph B. Mazzola Oct. 1980 65 p refs

(Contract N00014-75-C-0621; Grant NSF ECS-79-02506; NR Proj. 047-048)

(AD-A094190; MSRR-467; WP-20-80-81) Avail: NTIS HC A04/MF A01 CSCL 12/1

Any real-valued nonlinear function in 0-1 variables can be rewritten as a multilinear function. We discuss classes of lower and upper bounding linear expressions for multilinear functions in 0-1 variables. For any multilinear inequality in 0-1 variables, we define an equivalent family of linear inequalities. This family contains the set of generalized covering inequalities defined by Granot and Hammer. Several results concerning the relative strengths of inequalities within this family are presented. An algorithm for the general multilinear 0-1 program is given and computational experience with the algorithm applied to randomly generated problems is discussed. The use of the general procedure as an effective heuristic for multilinear 0-1 programs is also demonstrated. GRA

N81-18711# General Research Corp., Santa Barbara, Calif.

AN AUTOMATED PROGRAM TESTING METHODOLOGY AND ITS IMPLEMENTATION Interim Report

Dorothy M. Andrews and Jeoffrey P. Benson 1980 10 p refs

(Contract F49620-79-C-0115; AF Proj. 2304)

(AD-A094485; AFOSR-81-0057TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper describes an automated testing methodology and an experiment performed to determine its effectiveness. The method is to insert in the program to be tested a number of 'executable assertions, statements about the program that trigger error signals whenever they are evaluated to be false violated). A testcase is then developed for the program using actual values of the input variables. When the program is run, a plot is generated of the number of assertions violated versus the input variable values used. The resulting function is called the 'error function.' Heuristic search algorithms can then be used to maximize this function and thereby automatically locate input values which cause the most errors to occur. The experiment included developing assertions for the program to be tested, choosing and inserting representative errors into the program, and implementing search and data collection algorithms for testing. The results indicate that combining executable assertions with heuristic search algorithms in an effective method for automating the testing of computer programs. GRA

N81-18712# Maryland Univ., College Park. Computer Vision Lab.

PARALLEL COMPUTER FOR REGION-LEVEL IMAGE PROCESSING Interim Report

Azriel Rosenfeld and Angela Y. Wu Nov. 1980 35 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A094340; TR-978; AFOSR-81-0060TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

It is well known that parallel computers can be used very effectively for image processing at the pixel level, by assigning a processor to each pixel or block of pixels and passing information as necessary between processors whose blocks are adjacent. This paper discusses the use of parallel computers for processing images at the region level, assigning a processor to each region and passing information between processors whose regions are related. The basic difference between the pixel and region levels is that the regions (e.g., obtained by segmenting the given image) and relationships differ from image to image, and even for a given image, they do not remain fixed during processing. Thus one cannot use the standard type of cellular parallelism, in which the set of processors and interprocessor connections remain fixed, for processing at the region level. Reconfigurable cellular computers, in which the set of processors that each processor can communicate with can change during a computation, are more appropriate. A class of such computers is described and general examples are given illustrating how such a computer could initially configure itself to represent a given decomposition of an image into regions and dynamically reconfigure itself, in parallel, as regions merge or split. GRA

N81-18713# Maryland Univ., College Park. Computer Vision Lab.

SPATIAL AUTOREGRESSIONS IN DIGITAL IMAGE RESTORATION SIMULTANEOUS MODELS Interim Report

R. Chellappa Dec. 1980 26 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A094354; TR-984; AFOSR-81-0059TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

We consider the application of spatial autoregressive random field models in the restoration of degraded images. The degradation is assumed to be due to a space invariant, periodic, nonseparable point spread function and additive noise, colored or white. We assume that the images are represented by two dimensional spatial autoregressive models and we develop fast, optimal, non-recursive filters, the optimality criterion being the minimum mean squared error (MMSE). Within the class of spatial autoregressive models, there are two nonequivalent classes of random field (RF) models, the so-called simultaneous autoregressive (SAR) models and the conditional Markov (CM) models. In this paper, we develop restoration algorithms and give examples of restoration using the SAR models. The restoration filter is optimal, if the parameters characterizing the RF models are known exactly. In practice, however, they are estimated from the images. An iterative scheme is used for the estimation of parameters in SAR models. Performance bounds of restoration algorithms are calculated. In a subsequent paper, the case of CM models will be considered. GRA

N81-18714# Maryland Univ., College Park. Computer Vision Lab.

DIGITAL STRAIGHTNESS AND CONVEXITY Interim Technical Report

Azriel Rosenfeld and Chul E. Kim Dec. 1980 25 p refs
(Contract AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A094375; TR-990; AFOSR-81-0058TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This tutorial paper reviews the subjects of digital straightness and convexity. The central questions treated are: When can a digital arc be the digitization of a real straight line segment? When can a digital object be the digitization of a real convex set? GRA

N81-18715# California Univ., Livermore. Lawrence Livermore Lab. Mathematics and Statistics Div.

MONOTONE PIECEWISE CUBIC INTERPOLATION: ALGORITHMS AND SOFTWARE

F. N. Fritsch and R. F. Carlson Nov. 1980 35 p refs Presented at the SIAM 1980 Fall Meeting, 6-8 Nov. 1980, Houston, Tex.
(Contract W-7405-eng-48)
(UCRL-84644; CONF-801166-1) Avail: NTIS HC A03/MF A01

An improved algorithm for piecewise monotonic piecewise cubic interpolation is discussed. Plans for software implementing the algorithm are also described. DOE

N81-18716# Hanford Engineering Development Lab., Richland, Wash.

DEVELOPMENT OF A STANDARD FOR COMPUTER PROGRAM VERIFICATION AND CONTROL

T. E. Dunn 1980 10 p refs Presented at ANS Intern. Conf., Washington, D.C., 17 Nov. 1980
(Contract DE-AC14-76FF-02170)
(HEDL-SA-2215-FP) Avail: NTIS HC A02/MF A01

A standard set of guidelines was developed for establishing a control system to ensure the adequacy of scientific and engineering computer programs over a range of expected applications. The life cycle of a program is considered in three stages (definition; development; and operations and maintenance) in order to provide a framework for discussing activities that should occur during program development. It is expected that adherence to the guidelines of the ANS 10.4 will: (1) provide confidence that the program conforms to its requirements specification; (2) provide confidence that the computer program has been adequately evaluated and tested; (3) provide confidence that program changes are adequately evaluated, tested, and controlled; and (4) enhance assurance that reliable data will be produced for engineering, scientific, and safety analysis purposes. DOE

N81-18717# Sandia Labs., Albuquerque, N. Mex. Dept. of Mathematics.

RANK CORRELATION PLOTS FOR USE WITH CORRELATED INPUT VARIABLES IN SIMULATION STUDIES

R. L. Iman Nov. 1980 79 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1903) Avail: NTIS HC A05/MF A01

A method for inducing a desired rank correlation matrix on multivariate input vectors for simulation studies is discussed. The primary intention of this procedure is to produce correlated input variables for use with computer models. Since this procedure is distribution free and allows the exact marginal distributions to remain intact, it can be used with any marginal distributions for which it is reasonable to think in terms of correlation. A series of rank correlation plots based on this procedure when the marginal distributions are normal, lognormal, uniform, and loguniform is presented. These plots provide a convenient tool for both aiding the modeler in determining the degree of dependence among variables (rather than guessing) and communicating with the modeler the effect of different correlation assumptions. DOE

N81-18718# Sandia Labs., Livermore, Calif. Management Information Div.

COMPUTERIZED ART PLOTTING SYSTEM. 2: TWO-DIMENSIONAL GRAPHS

H. Yano and R. H. Tucker Nov. 1980 20 p
(Contract DE-AC04-76DP-00789)
(SAND-80-8038) Avail: NTIS HC A02/MF A01

By entering format information and data on a Tektronix 4014 terminal, the user can create, correct, and store two dimensional graphs with up to nine curves on rectangular, semilog, and log-log coordinates. Hard copies can be obtained in the form of prints from a Tektronix 4631 or 35 mm film from the computer. From the film, high quality prints, slides, and projection transparencies can be made. DOE

N81-18719# Bendix Field Engineering Corp., Grand Junction, Colo.

FORTRAN COMPUTER PROGRAMS TO PROCESS SAVANNAH RIVER LABORATORY HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE DATA

R. J. Zinkl, D. L. Shettel, Jr., and R. F. DAndrea, Jr. Mar. 1980 90 p refs
(Contract DE-AC13-76GJ-01664)
(GJBX-248(80)) Avail: NTIS HC A05/MF A01

FORTRAN computer programs to read, edit, and reformat the hydrogeochemical and stream sediment reconnaissance data produced by Savannah River Laboratory for the National Uranium Resource Evaluation program are described. The data are presorted by Savannah River Laboratory into stream sediment, ground water, and stream water for each 1 deg x 2 deg quadrangle. Extraneous information is eliminated, and missing analyses are assigned a specific value (-99999.0). Negative analyses are below the detection limit; the absolute value of a negative analysis is assumed to be the detection limit. DOE

N81-18720# Bendix Field Engineering Corp., Grand Junction, Colo.

LLLSRT: A FORTRAN COMPUTER PROGRAM FOR PROCESSING LAWRENCE LIVERMORE LABORATORY HSSR DATA

D. L. Shettel, Jr., R. F. DAndrea, Jr., and R. J. Zinkl Feb. 1980 44 p refs
(Contract DE-AC13-76GJ-01664)
(GJBX-247(80)) Avail: NTIS HC A03/MF A01

A FORTRAN computer program is presented that will read, edit, and sort hydrogeochemical and stream sediment reconnaissance (HSSR) data produced by the Lawrence Livermore Laboratory for the National Uranium Resource Evaluation program. The data are sorted into dry stream, wet stream, and lake/reservoir sediment samples and into ground water, surface water, and lake/reservoir water samples. Extraneous information is eliminated, and missing analyses are assigned a specific value. The error on each elemental analysis is used to check for below detection limit data. Output from the program occupies less than half the space of the original tape, reducing storage costs. DOE

N81-18721# Royal Netherlands Meteorological Inst., De Bilt. Bureau Methodiekontwikkeling en Evaluatie.

VERIFICATION OF AMERICAN 108- AND 132-HOUR PROGNOSES WITH THE HELP OF ANALOGS [VERIFICATIE AMERIKAANSE 108- EN 132-UURS PROGNOSES M.B.V. ANALOGEN]

H. A. F. M. Otten 1980 12 p refs In DUTCH
(KNMI-V-337) Avail: NTIS HC A02/MF A01

The American 7-layer model in the computation of daily weather prognosis is discussed. Long-term weather prognosis for 108 and 132 hours is verified and compared to scores from short-term prognosis and weather chamber results. Computations were made by analog methods. It was found that the analog method is very accurate on short-term prognosis; however, on the long-term forecast (72, 108, and 132 hrs) the computer models indicated systematic errors. Transl. by E.A.K.

N81-18722 Tennessee Univ., Knoxville.

THE REPRESENTATION OF DISCRETE FUNCTIONS BY DECISION TREES: ASPECTS OF COMPLEXITY AND PROBLEMS OF TESTING Ph.D. Thesis

Bernard Marcel Edmond Moret 1980 134 p
Avail: Univ. Microfilms Order No. 8104612

The activity of a variable, a concept that measures the contribution of a variable to the complexity of a function, is defined and its relation to decision trees is described. Based upon these results (which can be generalized to recursive functions and hierarchies of relations), a complexity measure is proposed. The use of that measure and of the concept of activity in testing large systems (where a number of variables may be

inaccessible) is then examined, with particular emphasis on continuous checking of systems in operation. Dissert. Abstr.

N81-18723 *State Univ. of New York at Buffalo, Amherst.*
REAL TIME SOUND SYNTHESIS: A SOFTWARE MICROCOSM Ph.D. Thesis
Michael John Manthey 1980 207 p
Avail: Univ. Microfilms Order No. 8027619

The definition, control, and generation of sound in real time using digital (as opposed to analog) technology is addressed. Design requirements were developed and realized in the form of a performance caliber instrument for the use of professional and amateur musicians and composers. Of primary interest is the nature of the software structures which were employed. A technique for system description, especially suited for concurrent systems is introduced. This technique may also be useful for the description, analysis, or design of other types of discrete systems, such as ecologies and economies. Dissert. Abstr.

N81-18724 Stanford Univ., Calif.
PROTOTYPES AND PRODUCTION RULES: A KNOWLEDGE REPRESENTATION FOR COMPUTER CONSULTATIONS Ph.D. Thesis
Janice Sue Aikins 1980 212 p
Avail: Univ. Microfilms Order No. 8103477

A system called CENTAUR is presented which demonstrates the effectiveness of representing prototypical knowledge in a combination of frames and production rules for performing computer consultations. Key knowledge representation and control structure problems in production rule systems similar to MYCIN are identified, and a set of important characteristics of the structures used for representing problem solving knowledge is given. The CENTAUR's frames, or prototypes, complement the production rules to satisfy these characteristics and represent expected patterns of data that permit a more focused, hypothesis directed approach to problem solving. Among the characteristics identified as desirable in the representation structures are the ability to explicitly represent: (1) prototypical cases; (2) the context in which knowledge is applied; and (3) the strategies for applying that knowledge. The CENTAUR's prototypes consist of patterns of knowledge in the domain whcih serve as broad contexts, guiding the more detailed processing of the production rules.
Author

N81-18990*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEEP SPACE NETWORK SOFTWARE COST ESTIMATION MODEL
R. C. Tausworthe *In its* The Telecommun. and Data Acquisition *15 Feb. 1981 p 39-57 refs (For primary document see* N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N81-18725 California Univ., Los Angeles.
COMPUTER-AIDED DESIGN AND EVALUATION OF DIGITAL COMPUTER SYSTEMS Ph.D. Thesis
Rami R. Razouk 1980 304 p
Avail: Univ. Microfilms Order No. 8104034

Methods are developed for performing automated control flow analysis. The interactive nature of the analysis tools serves to draw designer attention to the neighborhoods of pathologies and also serves to support mode modifications. Conventional program verification techniques are used in conjunction with SARA's (System Architect Apprentice) analytical tools to synergistically help in the verification of communication protocols. CCITT's recommendation is used to test the suitability of the Graph Model of Behavior and its supporting analytical tools to the modeling and verification of communication protocols. Analysis under the assumption of an error free transmission medium reveals many difficulties which are removed by a small number of modifications. Explicit error models are then introduced. In spite of a large increase in the number of states, the analysis tools succeed in pinpointing pathologies. Another fundamental SARA analysis tool, the graph model simulator, is presented. During top down refinement of a design, the simulator is used to test consistency between levels of abstraction. Dissert. Abstr.

N81-18726 *Washington Univ., St. Louis, Mo.*
SYNCHRONOUS NETS FOR SINGLE INSTRUCTION STREAM-MULTIPLE DATA STREAM COMPUTERS Ph.D. Thesis
Annette Jean Krygiel 1980 236 p
Avail: Univ. Microfilms Order No. 8103712

Synchronous Nets, or S Nets, are developed as a modeling tool particularized for describing processes on Single Instruction Stream Multiple Data Stream (SIMD) computers. S Nets are a modification of Petri Nets, using transitions and places to model events and conditions. However S Nets introduce vector mask places to model the conditions of the array resources of SIMD machines. These places are distinguished from scalar places which model the scalar resources. The underlying parallelism of the array hardware is modeled by the dimensionality of the vector element of the place, and the mask model's control of the vector aggregate as to the designation of which members of the aggregate will participate in the firing of subsequent transitions. S Nets also introduce a kind of transition. One type correlates with the Petri Net transition, but the mask firing transition is particularized to the SIMD environment, modeling the inherent capability of a computation executing on a SIMD machine to alter the participation of the vector aggregates in successor events. Also developed with S Nets are some quantitative measures to examine the parallelism achieved over a sequence of transition firings. Dissert. Abstr.

N81-18727 University of Southwestern Louisiana, Lafayette.
AN EXTENDED ABSTRACT DATAFLOW METHODOLOGY FOR DESIGNING AND MODELING RECONFIGURABLE SYSTEMS Ph.D. Thesis
Vason P. Srini 1980 310 p
Avail: Univ. Microfilms Order No. 8100289

A technique for designing and modeling reconfigurable systems and an execution environment for directly executing the models of systems are presented. The proposed technique is based on extended abstract dataflow graphs (EDFGs) using nondirect or partially directed graphs with nodes representing operations and arcs representing data paths. A model or schema configuration is an assignment of values to the attributes of the nodes and arcs. Special nodes, called configuration specifying nodes, can assign values to the attributes of nodes and arcs (reconfiguration). Reconfiguration is based on the information gathered from the nodes using 'snoop arcs.' A formal description of the technique and the execution of a graph are described. The issues related to what, when, and how to reconfigure are identified and resolved. Several reconfiguration strategies are presented using local information, global information, and a combination of the two. A conflict free approach to reconfiguration is presented. The properties of EDFGs that are useful in modeling independent events, concurrent events, nondeterministic events, and detecting parallelism are discussed. A distributed computer system environment for directly executing EDFGs is presented.
Dissert. Abstr.

N81-18728 California Univ., Los Angeles.
INTERACTIVE SYSTEMS WITH INTEGRAL HELP Ph.D. Thesis
Robert S. Fenchel 1980 204 p
Avail: Univ. Microfilms Order No. 8102825

A set of requirements for user assistance and more generally user interface design is given. A method for incorporating assistance information into the design process for interactive computer systems is presented. When implemented well, such integral assistance provides up-to-date, consistent and accurate information with a minimum of designer effort. In addition to techniques and tools to aid in the design of interactive systems, the design of a run-time presentation environment which was implemented and used is described. This environment provides a set of standard, powerful features which comprise an easy-to-use-user interface. The techniques developed have been applied to a large interactive system (SARA). Experiences with

their use in SARA serve as examples and are summarized for evaluation purposes. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N81-18729 California Univ., San Diego.

THE PROBLEM MANIPULATION/SOLUTION STRATEGY CONCEPT AND ITS APPLICATION TO LARGE-SCALE OPTIMAL CONTROL PROBLEMS Ph.D. Thesis

Howard Michael Koble 1980 255 p

Avail: Univ. Microfilms Order No. 8103789

Many algorithms which were developed for solving large scale mathematical programming problems utilize an indirect approach involving a pattern of problem manipulations and solution strategies. The problem manipulation phase involves the application of devices which restate the given mathematical program in an essentially equivalent alternative form which is more amenable to solution. The solution strategy phase involves the application of devices which reduce the alternative form to a sequence of simpler, but related problems. The degree of utility which this problem manipulation/solution strategy concept offers for facilitating the solution of deterministic, multi-stage optimal control problems is assessed. A large scale component aries in such problems when at least one of the following characteristics are present: a large number of state variables, a nonlinear plant equation, and ,state constraints at each stage of the dynamic process. Dissert. Abstr.

N81-18730 Syracuse Univ., N. Y.

RANDOM WALK MARKOV DECISION PROCESSES AND THEIR APPLICATIONS TO QUEUES Ph.D. Thesis

Fanglieh Victor Lu 1980 156 p

Avail: Univ. Microfilms Order No. 8104532

Three random walk Markov decision processes are studied: a random walk on the nonnegative integers that is downward skipfree, a simple random walk on the nonnegative integers and a multidimensional random walk. In each of these processes, the transition probabilities are controlled at each discrete time epoch and rewards are received based on the state of the walks and the controlled actions. In the simple random walk there is also a cost for changing the control actions. Sufficient conditions are presented on the reward functions and transition probabilities for these models that ensure the existence of certain natural monotone optimal control policies. Methods for computing monotone optimal policies are briefly discussed. Results on the random walk decision processes are applied to some queueing and marketing decision problems. Dissert. Abstr.

N81-18731# Air Force Academy, Colo. Frank J. Seiler Research Lab.

OPTIMAL PERIODIC CONTROL THEORY Final Report

Richard T. Evans Aug. 1980 178 p refs

(AD-A093622; FJSRL-TR-80-0024) Avail: NTIS HC A09/MF A01 CSCL 12/1

Existing conditions for locally optimizing a periodic process with free period are corrected, extended, and clarified using the strong properties of the Hamiltonian structure of the Optimal Periodic Control (OPC) Problem and the relationships of the second variation that result from the problem's periodicity constraints. A neighboring optimum feedback controller is determined which regulates all perturbations back to the locally minimizing periodic trajectory. This periodic regulator extends many of the concepts of the time invariant regulator. An illustrative problem is constructed to demonstrate the basic characteristics of this class of problem. A relatively comprehensive numerical investigation is conducted identifying a multiplicity of extremal solutions which are shown to form one-parameter families of solutions to the OPC. Bifurcation points, which define the critical periodic solutions common to intersecting families, are computed. Extremal solutions, satisfying all first order conditions, are tested for local sufficiency conditions by verifying the existence of the Ricatti: variable over one full period. The neighboring optimal feedback control law for a locally minimizing solution is tested by demonstrating the limit cycle behavior that results from perturbations to the initial conditions in a closed loop application. An asymptotic series expansion is derived for the illustrative problem using a perturbation technique. GRA

N81-18732# Texas A&M Univ., College Station. Telecommunication and Control Systems Lab.

NONLINEAR MODEL IDENTIFICATION FROM OPERATING RECORDS Final Report, Jun. - Dec. 1979

Bruce K. Colburn and Alvin R. Schatte Nov. 1980 97 p refs (Contract F49620-79-C-0091; AF Proj. 2313)

(AD-A094411; TCSL-80-01; AFOSR-81-0076TR) Avail: NTIS HC A05/MF A01 CSCL 12/2

Two basic response error (RE) model-reference adaptive system (MRAS) identifiers are derived for nonlinear model identification without advance knowledge of the nonlinearities. The methods are developed and shown to be applicable for systems with input and output measurement noise. Design consideration, comparison of linear and nonlinear model fits to a nonlinear plant are given. The applicability of such an approach for the human operator model is discussed. GRA

N81-18733# Bunker-Ramo Corp., Westlake Village, Calif. Electronic Systems Div.

EVALUATION OF FACTORS UNIQUE TO MULTIFUNCTION CONTROLS/DISPLAYS DEVICES Final Report, 1 Mar. - 30 Nov. 1977

Gloria L. Calhoun, Emmett L. Herron, John M. Reising, and Robert P. Bateman Wright-Patterson AFB, Ohio AFWAL Nov. 1980 133 p refs

(Contract F33615-78-C-3614; AF Proj. 2049; AF Proj. 2403)

(AD-A094227; AFWAL-TR-80-3131) Avail: NTIS HC A07/MF A01 CSCL 05/8

Aircraft which utilize computers will require the use of multifunction displays and keyboards (MFK). Eight arrangements of formats which present flight control, navigation, and status information were examined. All were found useable but arrangements in which attitude information was placed above navigation information and those utilizing electro-optical devices rather than conventional flight instruments were slightly better. Two types of MFK logic were also examined. MFK operation was more efficient with Tailored Logic (frequently used functions presented) than with Branching Logic (functions presented by systems). GRA

N81-18734# Naval Postgraduate School, Monterey, Calif.

REDUCED ORDER MODELS VIA CONTINUED FRACTIONS APPLIED TO CONTROL SYSTEMS M.S. Thesis

William Porras Sep. 1980 95 p refs

(AD-A094574) Avail: NTIS HC A05/MF A01 CSCL 12/2

Based on the theory of continued fractions, a technique is developed for the reduction of high order multivariable systems. The mathematical basis for which these techniques work is elucidated, and its superiority of the mixed form over any other form of continued fractions is established. The general solution to linear regulator problem is developed and the properties which this solution exhibit are elucidated. GRA

N81-18735 Rhode Island Univ., Kingston.

THE INFINITE HORIZON OPTIMAL CONTROL PROBLEM Ph.D. Thesis

Lynnell Elizabeth Stern 1980 120 p

Avail: Univ. Microfilms Order No. 8102341

The problems encountered in the infinite horizon optimal control problem are addressed, and finite horizon properties are extended to the infinite horizon case. Ideas in optimizing on the infinite time interval are developed and applied as well to periodic systems. The differences with the finite optimization problem are discussed. Different definitions of optimality in the infinite time interval are given, and the logical implications between them are stated. Corresponding comparison criteria are defined and other relations as well as two types of equivalence relations are established. A method of investigating optimality, involving what is called the determining set, is introduced. This leads to criteria for establishing necessary conditions for optimality in both finite and infinite horizon problems. These are applied to

the questions about transversality conditions at infinity and existence of periodic optimal solutions. Dissert. Abstr.

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-18736 Cornell Univ., Ithaca, N. Y.
***FLOATING POINT ARITHMETIC AND PROGRAM CORRECTNESS PROOFS* Ph.D. Thesis**
John Erick Holm 1980 140 p
Avail: Univ. Microfilms Order No. 8102943

Tight upper and lower bounds on the relative error in various schemes for performing floating point arithmetic are developed, axioms are proposed for characterizing the significant properties embodied by these schemes, and examples are given to illustrate how these axioms may be used to reason about the correctness of floating point programs. Three addition schemes are considered: (1) chopped addition, (2) addition with both pre and post-adjustment rounding, and (3) addition with pre-adjustment chopping and post-adjustment rounding. Schemes for performing both rounded and chopped multiplication and division are also considered. The tight bounds are consistent with the commonly held opinion that a binary base minimizes the maximum relative errors in floating point arithmetic. Also, these bounds show that one guard digit is optimal for minimizing the maximum relative errors in chopped addition. The bounds derived for each of the addition schemes considered are as tight as possible. One guard digit and two guard bits are shown to be sufficient to round the result of an exact addition to the nearest floating point number. Dissert. Abstr.

N81-18737 George Washington Univ., Washington, D.C.
NEWTON'S METHOD FOR LINEARLY CONSTRAINED *OPTIMIZATION PROBLEMS* Ph.D. Thesis
Fatemeh Ghotb 1980 125 p
Avail: Univ. Microfilms Order No. 8100525

Matrix techniques are developed to implement a modified Newton's method for linearly constrained nonlinear optimization problems. Formulas are given for both the projection and variable elimination methods of representing the nullspacematrix of the binding constraint gradients. The dyadic representation of the Hessian matrix of the factorable objective function is employed in the development of formulas for the updating of the generalized inverse of a matrix perturbed by a matrix of rank one. These techniques were used to compute an estimate of the positive part of the reduced Hessian matrix. Several test problems were used to determine which of the combinations of matrix techniques is most efficient. Dissert. Abstr.

N81-18738 Stanford Univ., Calif.
BINARY INTEGER LINEAR *PROGRAMMING*: A HYBRID IMPLICIT ENUMERATION APPROACH Ph.D. Thesis
Nancy Eileen Jacqmin 1980 108 p
Avail: Univ. Microfilms Order No. 8103524

A hybrid algorithm to solve the binary integer linear programming problem is developed. This problem involves optimizing a linear objective function subject to a set of linear inequalities where, in addition, the variables are required to take on the value 0 or 1. The approach developed is that of implicit enumeration; that is, the set of all possible binary combinations of values for the variables is searched without considering each combination explicitly. This is accomplished by applying a series of tests which when satisfied allow immediate elimination of large subsets of these completions. Borrowing penalties and pseudocosts as well as binary infeasibility and conditional binary infeasibility tests from previous approaches, the algorithm is built to use each of their strengths. In addition, an existing heuristic procedure is used to generate a good feasible binary point at the outset. Thus, a good initial bound on the optimal function value is available. There is, however, a general weakness in tests since they can really only be applied to one variable at a time. Hence, a technique to obtain joint bounds on the values of a subset of the variables is developed. Dissert. Abstr.

N81-18739 Purdue Univ., Lafayette, Ind.
CONTROL AND COMPUTATION FOR MECHANICAL MANIPULATORS Ph.D. Thesis
Chun-Shin Lin 1980 191 p
Avail: Univ. Microfilms Order No. 8102680

Parallel computation of input torques, straight-line segments path planning, and approximation of joint trajectories are addressed. To schedule tasks for parallel processing, first the entire task is divided into subtasks. Based on the precedence relations, an optimum order to execution for each CPU is obtained by using a scheduling algorithm which is developed based on an idea extended from the method of branch-and-bound. The path planning deals with the motion of the hand along straight line path. While considering constraints on the maximum acceleration and velocity of the hand, a large number of nonlinear inequality constraints are involved. Method of Approximate Programming is adopted and modified to obtain a minimum traveling time. Methods with concepts of spline functions and least square error fit are used to approximately express a Cartesian path of a hand in joint trajectories. Joint position, velocity, and acceleration are all kept continuous at any point where two polynomials are splined together. Such approximation allows one to control the traveling path of a hand, which is specified in the Cartesian coordinates, at the joint level, and thereby reduces some computations for the coordinates transformation of the path. Dissert. Abstr.

N81-18740 Carnegie-Mellon Univ., Pittsburgh, Pa.
NUMERICAL APPROXIMATION OF SOLUTIONS TO GENERAL STEFAN PROBLEMS *Ph.D. Thesis*
James Felts Epperson 1980 110 p
Avail: Univ. Microfilms Order No. 8100610

A finite element method for approximating weak solutions to Stefan problems is presented. Under mild and physically reasonable assumptions on the exact solution, the approximate solution is shown to converge in L(2)-norm at the rate O(h1/2 + epsilon 1/2), where h is the finite element grid spacing and epsilon is a small smoothing parameter. The method, which is equally applicable to multidimensional and multiphase problems, is shown to lead to a system of mildly nonlinear equations whose solution can be computed by an SOR iteration. *Dissert. Abstr.*

N81-18741 Tennessee Univ., Knoxville.
***THE GALERKIN METHOD FOR FIRST ORDER HYPERBOLIC* EQUATIONS Ph.D. Thesis**
William J. Layton 1980 112 p
Avail: Univ. Microfilms Order No. 8104602

Certain problems arising in the approximate solution of first order hyperbolic equations and systems of equations are studied and resolve via Galerkin methods. In particuar three general questions are considered and particular cases of them answered satisfactorily. The type of equations and question are chosen as models for a theoretical of questions important in applications. Dissert. Abstr.

N81-18742*#* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTED AND EXPERIMENTAL STEADY AND UNSTEADY TRANSONIC FLOWS ABOUT A BICONVEX AIRFOIL
Lionel L. Levy, Jr. Feb. 1981 20 p refs
(NASA-TM-81262; A-8457) Avail: NTIS HC A02/MF A01 CSCL 20D

Results of computer code time dependent solutions of the two dimensional compressible Navier-Stokes equations and the results of independent experiments are compared to verify the Mach number range for instabilities in the transonic flow field about a 14 percent thick biconvex airfoil at an angle of attack of 0 deg and a Reynolds number of 7 million. The experiments were conducted in a transonic, slotted wall wind tunnel. The computer code included an algebraic eddy viscosity turbulence model developed for steady flows, and all computations were made using free flight boundary conditions. All of the features documented experimentally for both steady and unsteady flows were predicted qualitatively; even with the above simplifications, the predictions were, on the whole, in good quantitative agreement with experiment. In particular, predicted time histories of shock wave position, surface pressures, lift, and pitching moment were

found to be in very good agreement with experiment for an unsteady flow. Depending upon the free stream Mach number for steady flows, the surface pressure downstream of the shock wave or the shock wave location was not well predicted. M.G.

N81-18743*# National Aeronautics and Space Administration, Washington, D. C.

RAPID CORRELATION ANALYSIS IN A GROUP OF MOTIONS AND HOMOGENEOUS SCALE TRANSFORMS OF THE PLANE (M(2)XR SUB +)

D. K. Tkhabisimov Aug. 1980 13 p refs Transl. into ENGLISH of "Bystryy korrelyatsionnyy analiz na gruppe dvizheniy i odnorodnykh masshtabnykh preobrazovaniy ploskosti (M(2)xR sub +)" Rept. Pr-367 Moscow, 1977 11 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow

(Contract NASw-3199)

(NASA-TM-76230) Avail: NTIS HC A02/MF A01 CSCL 12A

A method is proposed for picking out a given image, in a plane, irrespective of translations, rotations, and homogeneous scale transforms of the plane. The correlation integral is calculated, using the method of abstract harmonic analysis. In this case, and also for groups of translations, it is possible to carry out the calculations using the rapid Fourier transform. The latter fact makes it possible to substantially reduce the number of computer operations for calculating the correlation integral, as compared with direct methods. Author

N81-18744*# National Aeronautics and Space Administration, Washington, D. C.

POLYNOMIAL STRICTION ALGORITHMS IN THE DETECTION AND DETERMINATION OF THE CHARACTERISTICS OF NON-STATIONARY PHENOMENA

V. P. Yevdokimov and M. Ya. Natenzon Aug. 1980 32 p refs Transl. into ENGLISH of "Polinomialnye algoritmy szhatiya v zadache obnaruzheniya i opredeleniya kharakteriistik nestatsionarnykh yavleniy" Rept. Pr-409, Moscow, 1989 30 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow

(Contract NASw-3199)

(NASA-TM-76245) Avail: NTIS HC A03/MF A01 CSCL 12A

The effectiveness of the algorithm of polynomial striction of the data is examined, and the selection of an algorithm is carried out, according to the results of measurements of the components of the permanent magnetic field in communication sequences from the Venera-9 space vehicle, where the shock waves were recorded. It is shown that the most effective algorithm, according to the coefficient of striction, is the algorithm of the zero order interpolator. Also examined is the increase in effectiveness with the introduction of a variable threshold of comparison. The root-mean-square deviation of the error of regeneration of the data with various thresholds is calculated, and qualitative analysis of the distortions is carried out, having shown a considerable change in the form of the small discontinuities, which may be interpreted as potential interplanetary shock waves. Author

N81-18745# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

APPROACHES FOR CONVERGENCE OF A BASIC ITERATIVE METHOD FOR THE LINEAR COMPLEMENTARITY PROBLEM

Jong-Shi Pang Nov. 1980 35 p refs

(Contract N00014-75-C-0621; Grant NSF ECS-79-26320; NR Proj. 047-048)

(AD-A094235; MSRR-466; WP-24-80-81) Avail: NTIS HC A03/MF A01 CSCL 12/1

Iterative methods have been found very useful for solving many large linear complementarity problems arising from applications. In this paper, we formulate a basic algorithm and use it as a unifying framework for the study of such methods. Next, we apply various strategies to investigate the convergence of the basic algorithm. Finally, we discuss the possibility of extending the analysis presented here to treat other complementarity and variational problems. GRA

N81-18746# Kentucky Univ., Lexington. Dept. of Electrical Engineering.

SOME NUMERICAL METHODS FOR EXPONENTIAL ANALYSIS WITH CONNECTION TO A GENERAL IDENTIFICATION SCHEME FOR LINEAR PROCESSES Technical Report, 15 May 1978 - 15 Feb. 1980

Jon R. Auton and L. Wilson Pearson Nov. 1980 78 p refs

(Contract N00014-77-C-0362)

(AD-A094228; RR-80-5) Avail: NTIS HC A05/MF A01 CSCL 12/1

A general identification scheme for linear processes is presented and related to some well-known exponential analysis methods such as Prony's method and the pencil-of-functions method. An elucidating explanation of the source of error (bias) for the general scheme is given. Some variations of the pencil-of-functions method are given an intense examination with some revealing numerical examples. A new exponential analysis method, called the adaptive method, is developed from the general scheme. Numerical examples of the adaptive method demonstrate its excellent performance in the presence at high levels of noise. Recommendations are made concerning the use of the adaptive method and directions for further work. GRA

N81-18747# Maryland Univ., College Park. Dept. of Computer Science.

A NEW METHOD FOR SOLVING LINEAR INEQUALITIES

G. W. Stewart Nov. 1980 12 p refs

(Contract N00014-76-C-0391)

(AD-A094232; TR-970) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper describes a new method for finding nontrivial solutions of the inequality $Ax > or = 0$, where A is an mxn matrix of rank n. The method is based on the observation that a certain function f has a unique minimum if and only if the inequality fails to have a nontrivial solution. Moreover, if there is a solution, the direction of divergence of an attempt to minimize f will converge to a solution. The technique can also be used to solve inhomogeneous inequalities and hence linear programming problems, although no claims are made about competitiveness with existing methods. GRA

N81-18748# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.

ON MULTICHANNEL (MULTIVARIATE) MAXIMUM ENTROPY SPECTRAL ANALYSIS

C. H. Chen and Chihsung Yen 23 Jan. 1981 22 p refs

(Contract N00014-79-C-0494)

(AD-A094238; SMU-EE-TR-81-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

After a review of the mathematical theory of the multichannel (multivariate) maximum entropy analysis, the computer programs on the multichannel analysis are developed and applied to the multichannel sinusoids and multichannel geophysical data, and to the segmentation of infrared images. GRA

N81-18749 Stanford Univ., Calif.

ON THE APPROXIMATE SOLUTION OF HYPERBOLIC INITIAL-BOUNDARY VALUE PROBLEMS Ph.D. Thesis

William Marvin Coughran, Jr. 1980 178 p

Avail: Univ. Microfilms Order No. 8103498

The existing stability theory for discrete initial boundary value problems, which has only been applied to scalar model problems, is used to analyze the stability of some 2 x 2 model problems not written in characteristic variables; it is noted that the most accurate interior/boundary difference scheme combinations are the least stable to perturbations in the coefficients. The stability results for 2 x 2 systems can be used in the stability analysis of larger systems where characteristics occur only singly and in pairs; in particular, discretizations of the wave equation, the shallow water equations, and the Eulerian equations for gas dynamics, which involve boundary conditions written in natural variables, are examined. The stability theory is also extended to multi-dimensional initial boundary value problems by means of the concept of tangential dissipativity; as an application, a tangentially dissipative leap frog method is shown to be stable with Euler boundary conditions for a two dimensional wave equation problem. The viability and limitations of the theory are demonstrated with some computational experiments. Finally,

combining stability results with accuracy considerations, various approximations and boundary conditions are ranked.
Dissert. Abstr.

N81-18750 Stanford Univ., Calif.
GAUGE THEORIES ON FOUR-DIMENSIONAL RIEMANNIAN MANIFOLDS Ph.D. Thesis
Thomas Henry Parker 1980 127 p
Avail: Univ. Microfilms Order No. 8103545

The analytic aspects of the Yang-Mills theory on four-dimensional manifolds is discussed. Various results known for Yang-Mills fields are extended to other gauge theories. The Yang-Mills theory is easily described in terms of modern differential geometry. One begins with a principal bundle P with compact structure group over a manifold M. The Yang-Mills field is then the curvature F of a connection on P, which is a critical point of the Yang-Mills action, the integral over M of the norm squared of F. Physically, Yang-Mills fields represent forces. As such, they interact with a second type of field, the field of a particle. This is interpreted as a section of a vector bundle associated to P and the Yang-Mills action is appropriately modified. The critical points of this modified action are solutions to a pair of coupled nonlinear partial differential equations, the coupled Yang-Mills equations. They are invariant under the infinite dimensional gauge group of all fiber preserving automorphisms of P. This setup constitutes a gauge theory and is the subject of this thesis. Dissert. Abstr.

N81-18751 California Univ., Los Angeles.
INVARIANT MEASURES FOR THE ZERO RANGE INFINITE PARTICLE SYSTEM Ph.D. Thesis
Enrique Daniel Andjel 1980 75 p
Avail: Univ. Microfilms Order No. 8103982

On a countable set of sites S, the zero range process is constructed when the stochastic matrix p(x,y) determining the one particle motion satisfies a mild assumption. The set of invariant measures for this process is described in the following two cases: (1) the system is attractive and p(x,y) is recurrent; and (2) the system is attractive, P(x,y) corresponds to a simple random walk on the integers and the rate at which particles leave any site is bounded. Dissert. Abstr.

N81-18752 Cornell Univ., Ithaca, N. Y.
TRUST REGION STRATEGIES FOR UNCONSTRAINED AND CONSTRAINED MINIMIZATION Ph.D. Thesis
Avi Vardi 1980 167 p
Avail: Univ. Microfilms Order No. 8103017

A trust region algorithm using the BFGS update for unconstrained minimization problems is developed. Global and superlinear convergence theorems are given. Algorithms for nonlinear constrained minimization problems usually determine a quasi Newton direction and use a line search technique to determine the step. A trust region strategy for equality constrained minimization is also developed. This algorithm is analyzed and global as well as local superlinear convergence theorems are proved for various versions. How to implement these algorithms in a numerically stable way is demonstrated. Two computer programs based on these algorithms are presented. Numerical results are provided. Dissert. Abstr.

N81-18753 Cornell Univ., Ithaca, N. Y.
BOUNDARY BEHAVIOUR OF LIMITS OF DISCRETE SERIES REPRESENTATIONS Ph.D. Thesis
Brian Evan Blank 1980 199 p
Avail: Univ. Microfilms Order No. 8102939

The problem of exhibiting the known reducibility of certain continuous series representations of semisimple Lie groups in a global analytic fashion is solved. Let G be a connected semisimple linear Lie group that has a compact Cartan subgroup and let P be a cuspidal parabolic subgroup of G. It is shown that when P is constructed from a simple noncompact root in a standard way this reducibility can be obtained by a G-equivariant weak-L(2) boundary value embedding of limits of discrete series representations. A major step towards this end is the expansion of the setting in which the Szego integrals apply. The representation space of limits of discrete series are then realized as images of unitary P-induced representations under these Szego maps. In this way K-finite elements of limits of discrete series respresentations can be expressed as Eisenstein integrals of suitably specified cusp forms. The constant terms of these integrals then provide the required G-equivariant boundary value embedding. For groups of real rank one, these boundary value limits are computed directly. Dissert. Abstr.

N81-18754 Kent State Univ., Ohio.
INTERPOLATION IN ABSTRACT SPACES Ph.D. Thesis
Boris Shekhtman 1980 80 p
Avail: Univ. Microfilms Order No. 8100693

An effort is made to give an abstract approach to some features of the theory of interpolation within the framework of functional analysis. The terminology of interpolation in abstract spaces is introduced. Existence, uniqueness, and characterization theorems for various interpolation processes are established and their properties are proved. The convergence properties of interpolation projections and of spline projections in abstract Hilbert space are investigated. Different examples of interpolation processes are given and abstract theorems are applied to obtain results and to improve classical results. Dissert. Abstr.

N81-18755 George Washington Univ., Washington, D.C.
MIXING, ERGODICITY, AND AMENABILITY FOR WEAKLY ALMOST PERIODIC SEMIGROUPS Ph.D. Thesis
John Richard Tucker 1980 67 p
Avail: Univ. Microfilms Order No. 8101490

An abstract version of the classical weak mixing theorem of ergodic theory is extended to the case of a weakly continuous representation of a left and right amenable semitopological semigroup S as uniformly bounded operators on a Hilbert space. The extension makes use of a theory of almost periodic compactifications, and permits a Peter-Weyl type decompositon of that part of the Hilbert space on which the operators act as a group. Next, conditions implying the left and right amenability of a semigroup S are examined. Finally, several ergodicity and amenability properties are shown to be equivalent for an equicontinuous semigroup of continuous linear operators on a locally convex space when the convex hull of the semigroup is weakly almost periodic. Dissert. Abstr.

N81-18756 George Washington Univ., Washington, D.C.
CHROMATIC EQUIVALENCE AND CHROMATIC UNIQUENESS Ph.D. Thesis
Steven Zalmon Kahn 1980 247 p
Avail: Univ. Microfilms Order No. 8101481

Several methods for constructing chromatically equivalent graphs are presented. A planar graph may be chromatically equivalent to nonplanar graph. For any integer k > or = 2 equivalent graphs G and H with k components such that no component of G is chromatically equivalent to any component of H. Path-reflected pairs of order k for k > or = 2 are defined. Any path-reflected pair of order 2 forms a pair of chromatically equivalent graphs. Edge-addable graphs are defined and four types of edge-addable graphs presented. These four types are formed by attaching tents to a path, a cycle, a wheel or to another tent. For each type of graph, many families of chromatically equivalent graphs are obtained. The four types of graphs are called multi-theta graphs, chains, multi-chains and generalized multi-chains. Results on chromatic uniqueness are presented.
Dissert. Abstr.

N81-18757 Oregon Univ., Eugene.
ON THE EXISTENCE, UNIQUENESS AND REGULARITY OF SOLUTIONS TO BOUNDARY VALUE PROBLEMS FOR ELLIPTIC SYSTEMS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS OF MIXED ORDER Ph.D. Thesis
John Alan Ladwig 1980 67 p
Avail: Univ. Microfilms Order No. 8101845

Three theorems concerned with the existence, uniqueness, and regularity of solutions to boundary value problems for elliptic systems of partial differential equations are established. The first result, theorem II.2.1, gives necessary and sufficient conditions for the existence, uniqueness, and regularity of solutions to boundary value problems for elliptic systems with constant coefficients in a half space. The remaining results relate to systems with variable coefficients and functions defined on a uniformly regular domain. Theorem III.2.1 gives a sufficient condition for the boundary problem to yield a Fredholm operator, while theorem

III.3.1 is a resolvent-type estimate in the case of null boundary data for a single elliptic equation. The methods employed are based on Fourier transform and contour integral representations of solutions to systems of ordinary differential equations with constant coefficients on a half-line, linear algebra, functional analysis and the theory of Sobolev spaces. Dissert. Abstr.

N81-18758 State Univ. of New York at Stony Brook.
PROJECTION METHODS IN THE SOLUTION OF SYSTEMS OF NONLINEAR EQUATIONS Ph.D. Thesis
Yuri Nakai 1980 136 p
Avail: Univ. Microfilms Order No. 8101901

The projection methods are iterative methods first developed for solving a system of linear equations Ax = b, where A is a square, nonsingular matrix. Two methods, the block row and block column projection methods are singled out and are studied in conjunction with the problem of solving a system of nonlinear equations. A summary of the properties of the two methods when applied to the linear problem is given, and the generalizations of these two methods to the nonlinear problems are stated and classified according to current schemes. An algorithm which selects the correction subspace in the column projection method is given. Several other algorithms which combine the column projection method with the steepest descent method are described. It is shown that certain variations of the column projection method can be applied to the nonlinear least squares problem and proofs of their convergence are given. Numerical results and comparisons of the various methods are presented. Dissert. Abstr.

N81-18759 Purdue Univ., Lafayette, Ind.
COMPUTABLE ERROR BOUNDS AND THE RITZ METHOD IN ONE DIMENSION PLUS THE NUMERICAL APPROXIMATION OF A MODEL CONVECTION-DIFFUSION EQUATION Ph.D. Thesis
Eugene Charles Gartland, Jr. 1980 61 p
Avail: Univ. Microfilms Order No. 8102654

A posteriori error estimation for the numerical approximation by the Ritz method, of the solutions of linear, self-adjoint, second-order, two-point boundary value problems, so-called linear source problems, is treated. The Ritz method is an orthogonal projection method on the energy space, which space is a reproducing kernel Hilbert space with kernel function the Green's function for the original boundary value problem. By interpreting the Ritz method as an instance of optimal recovery, bounds for the pointwise values, maximum norm, and least squares norm of the error that are the best possible are obtained, given the information used in computing the approximation. The numerical approximation of a linear, constant-coefficient, non-self-adjoint, second-order, elliptic partial differential equation, with Dirichlet boundary conditions, on a rectangle in two dimensions, a so-called convection-diffusion equation is derived. Dissert. Abstr.

N81-18760 Syracuse Univ., N. Y.
ZEROS AND POLES OF PADE APPROXIMANTS Ph.D. Thesis
Gary Alan Federici 1980 94 p
Avail: Univ. Microfilms Order No. 8104523

A classical method is presented for deriving from a given power series, rational approximations of its sum. It consists of a rational function called the Pade approximant. The numerator, P sub mn (z) and denominator Q sub mn (z) are polynomials of degrees not exceeding m and n, respectively, and whose expansion in acending powers of z agrees, term by term, with the given series for as many terms as possible. The rational approximant is placed in the nth row and mth column of a double entry array (m more than or equal to 0, n more than or equal to 0).
Dissert. Abstr.

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-18761 Alabama Univ., University.
ESTIMATING COMPONENTS OF VARIANCE FOR THE COMPLETELY RANDOM MODEL Ph.D. Thesis
Helen Calvert Takacs 1980 113 p
Avail: Univ. Microfilms Order No. 8100593

A procedure for computing the variance-covariance matrix for the estimators of variance components in a general completely random model is provided. The procedure uses the full rank cell means model and computes sums of squares using the numerators of F tests for hypotheses about the cell means. It works for any model, whether or not the design has an unequal number of observations per cell and whether or not the design has missing values. Its efficiency does not depend on the number of observations per cell. It will compute a variance-covariance matrix for any method as long as known variance components are specified and as long as there are as many hypotheses stated as there are variance components to be estimated.
Dissert. Abstr.

N81-18762 Alabama Univ., University.
PRINCIPLE COMPONENTS BIASED PROCEDURES APPLIED TO DISCRIMINANT ANALYSIS Ph.D. Thesis
Enoch Charles Temple 1980 120 p
Avail: Univ. Microfilms Order No. 8104095

Certain alterations on the sample variance covariance matrix which produces several different based sample linear discriminant functions are proposed. The performance of the biased discriminant functions are compared through Monte Carlo experiments. The seventy-two different configurations consist of different sample sizes, degrees of near-singularity in the population variance covariance matrix, Mahalonobis distances between the populations, and the orientations of the mean vectors. Comparitive performance is based on the conditional probability of misclassification. Cases in which certain biased procedures are effective are identified. Dissert. Abstr.

N81-18763 New York State Univ., Binghamton.
TESTING FOR ROBUSTNESS OF CERTAIN F-TESTS IN THE GENERAL LINEAR MODEL Ph.D. Thesis
Gene Dale Sprechini 1981 82 p
Avail: Univ. Microfilms Order No. 8103047

A test is proposed for detecting only those types of unequal variance situations where the true significance level of the standard F-test is substantially higher than acceptable. Also a test for normality is given which can be performed on several populations of possibly different means and variances. This is in contrast to using residuals which are not independent or performing a separate test on each population. The above tests are extended to other special cases of the general linear model. One is the two-way analysis of variance where the F-test for interaction is of interest. Another is the linear regression in one variable (with repeated values), where an F-test for a nonzero slope is made.
Dissert. Abstr.

N81-18764 Cornell Univ., Ithaca, N. Y.
RIDGE AND JAMES-STEIN METHODS FOR CONTINGENCY TABLES Ph.D. Thesis
Ayodele Osadebaima Ighodaro 1980 152 p
Avail: Univ. Microfilms Order No. 8102989

Multinomial estimation is examined within the framework of decision theory and useful analogues of normal-theory shrinkage techniques are developed for the problem. The statistical decision problems squared loss, L sub 1, entropy loss, L sub 2, and relative sub 2, squared loss, L sub 3, are defined and investigated. The relationships between the classes of Bayes estimators and admissible estimators under L sub 1 and L sub 2 are clearly specified and the minimal complete class under L sub 2 is characterized. Analogues of literative ridge methods are suggested and derived in detail under L sub 1. A characterization for the ridge estimator is given for a class of Bayes estimators under L sub 2 and is used to obtain a ridge trace estimator. A Monte Carlo study is performed to evaluate the risk characteristics of the estimators proposed and of other estimators in the recent literature. Finally, an analogue of the James-Stein estimator is derived for estimation in multidimensional contingency tables and its asymptotic properties investigated. Dissert. Abstr.

N81-18765 Cornell Univ., Ithaca, N. Y.
CONSTRUCTION OF CONDITIONAL STATISTICS FOR CHI-SQUARE GOODNESS OF FIT TESTS Ph.D. Thesis
Charles Elliott McCulloch 1980 118 p

Avail: Univ. Microfilms Order No. 8102993

A goodness of fit test for a distribution g(x,theta), with nuisance parameter theta, in a setting in which the data is grouped into cells. The test statistic investigated is a quadratic form in the vector of standardized cell frequencies. Under a sequence of local alternatives it behaves as a standardized comparison of two estimators of, the maximum likelihood estimator based on the cell frequencies. This thesis shows that the null hypothesis the limiting distribution of the test statistic is central chi-square with degrees of freedom equal to the number of estimated parameters. Within the exponential family the results are shown to hold for random cells that are data dependent through the maximum likelihood estimator theta based on the original observations. The specific cases of the statistic for testing goodness of fit to the exponential, univariate normal, gamma, circular bivariate normal and multivariate normal distributions are calculated. The behavior of the proposed statistic under alternatives is investigated by calculation of the approximate Bahadur slope and by calculation of the limiting distribution under a sequence of local alternatives Dissert. Abstr.

N81-18766 Cornell Univ., Ithaca, N. Y.
THE VARIANCE TIME CURVE: THEORY, ESTIMATION AND APPLICATIONS Ph.D. Thesis
Marc S. Meketon 1980 208 p
Avail: Univ. Microfilms Order No. 8102964

The estimation of the variance time curve and its derivative for arbitrary stationary increment processes are studied in detail. Consistency and finite dimensional convergence of the estimation are proved. It is shown that estimation of the distribution function may be phrased in terms of stochastic integrals. The theory is extended to nonstationary increment processes. Nonparametric estimation of the asymptotic slope of the variance time curve is studied, as well as parametric estimation of the variance time curve. In the latter case, a continuous time generalized least squares model is introduced for the parametric estimation. Examples of the techniques developed are presented. In one example the stochastic process is derived from stock market data, and in the other examples the process is simulated. Finally, extensions of the theory are examined. Multivariate stochastic processes, ratio estimation, replications, and third order effects are presented. Bioscience/medical applications of these extensions are cited. Dissert. Abstr.

N81-18767 Alabama Univ., University.
BIASED ESTIMATION IN POLYNOMIAL REGRESSION Ph.D. Thesis
Hsiao-Ling Liu 1980 133 p
Avail: Univ. Microfilms Order No. 8104079

The use of some biased estimation techniques (principal component regression, ridge regression, and latent root regression) as a means of ameliorating the adverse effect of linear dependencies in a polynomial regression model is investigated. The nonstochastic estimation methods are compared with least squares based on theoretical properties of the estimators for two-term models, and one-term third degree models for which values of the predictor variable are equally spaced and centered. Contours of equality for pairs of theoretical mean squared errors of the estimates of the regression coefficients for differenc estimation procedures are given. Also, the results of simulations for 3rd and 4th power polynomial regresssion models are presented and used to explore the conditions under which the different estimation procedures give the best estimates in terms of the mean squared error of estimates of the parameters of the model. Dissert. Abstr.

N81-18768 George Washington Univ., Washington, D.C.
TWO STATISTICAL PROBLEMS INVOLVING THE BIVARIATE NORMAL DISTRIBUTION ARISING FROM LEGAL ISSUES Ph.D. Thesis
Nancy Lyon Spruill 1980 107 p
Avail: Univ. Microfilms Order No. 8101489

Two related problems are addressed which arose from the Privacy Act and the Equal Employment Act, respectively. The first problem results from restrictions which were imposed on the exchange of individual data by government or research agencies in order to preserve the confidentiality of the data. The second problem arises when an employer (e.g., university) hires for two positions and some of the applicants are couples. That is, the employer needs either to offer both jobs to one of the couples or each job separately to single applicants (single is defined as anyone who does not have a spouse who is applying for the other job). Dissert. Abstr.

N81-18769 Florida State Univ., Tallahassee.
A NEW METHOD FOR ESTIMATING LIFE DISTRIBUTIONS FROM INCOMPLETE DATA Ph.D. Thesis
John Francis Kitchin 1980 92 p
Avail: Univ. Microfilms Order No. 8104261

An estimator for a continuous life distribution from incomplete data, the Piecewise Exponential Estimator (PEXE) is constructed. The asymptotic (large sample) properties of the PEXE are established. Results include the strong consistency of the PEXE under various sets of assumptions plus the weak convergence of the PEXE, suitable normalized, to a Gaussian process. From an intermediate result in weak convergence proof asymptotic confidence bands and a goodness-of-fit test based on the PEXE are derived. Dissert. Abstr.

N81-18770 Stanford Univ., Calif.
AN ADAPTIVE CHOICE OF THE SCALE PARAMETER FOR M-ESTIMATORS Ph.D. Thesis
Robert Michael Bell 1980 78 p
Avail: Univ. Microfilms Order No. 8103484

Since, for a given function psi, the variance of the corresponding M ESTIMATOR varies considerably with the value of the scale parameter, it is proposed that the value which minimizes an estimate of the asymptotic variance of the M estimator be used as the scaling factor. This adaptive method of scaling is shown to be asymptotically optimal (under fairly general conditions) in the sense that the resulting M estimator has the smallest possible asymptotic variance among all M estimators based on psi. In particular, when the underlying distribution is normal, the adaptive estimator based on any reasonable psi achieves full asymptotic efficiency, i.e., is asymptotically equivalent to the sample mean. The performance of the estimator for small samples is investigated by Monte Carlo methods for several choices of psi using the triefficiency criteria. A slight modification of the above estimator compares favorably with Tukey's bisquare M estimator for sample sizes as small as 20. Dissert. Abstr.

N81-18771 Stanford Univ., Calif.
NONPARAMETRIC ESTIMATION FROM CENSORED BIVARIATE OBSERVATIONS Ph.D. Thesis
Alvaro Munoz 1980 67 p
Avail: Univ. Microfilms Order No. 8103540

A generalized maximum likelihood estimator (GMLE) is proposed for the problem of estimating the joint distribution function of two failure times when they are subject to an independent univariate censoring function. It is compared with the analogous univariate solution (the Kaplan-Meier estimator). The GMLE is shown to be the only self-consistent estimator up to the last censored observations in both dimensions. Applications to medical survival studies are indicated with an example. Discrepancies between the marginals of the estimator and those achieved by univariate methods are noted. A method to achieve a GMLE precisely defined at most points is indicated.
Dissert. Abstr.

N81-18772 Texas Univ. at Arlington.
THEORY AND APPLICATIONS IN THE COMPARISON ESTIMATORS Ph.D. Thesis
Jerome Paul Keating 1980 92 p
Avail: Univ. Microfilms Order No. 8103772

Methodology is given for the pairwise comparison of estimators in a restricted class based on mean absolute error. The comparison of estimators is restricted to those estimators which can be resolved into monotone functions of a common statistic. Mean absolute error is decomposed through the theorem of total expectation. In evaluating each component in the decomposition of mean absolute error, a solution is given for Pitman's measure of closeness. Inadequacies in pairwise comparisons of several viable estimators necessitate the discovery of a principle of a simultaneous comparison of estimators. A general procedure for the simultaneous comparison of estimators is presented. This procedure is refined into exact

solutions for the simultaneous decomposition components for scale invariant statistics of a scale parameter. Pertinent applications are given for each type of comparison. Dissert. Abstr.

N81-18773 Purdue Univ., Lafayette, Ind.
SOME RESULTS IN THE THEORY OF SUBSET SELECTION PROCEDURES Ph.D. Thesis
Hwa-Ming Yang 1980 151 p
Avail: Univ. Microfilms Order No. 8102724

The problem of selecting a subset containing all populations that are better than a control under the assumptions of an ordering prior is considered. An ordering prior is a known simple or partial order relationship among the unknown parameters of the treatments (excluding the control). Three new selection procedures are proposed and studied. Two of the three procedures use the isotonic regression over the sample means of the k treatments with respect to the give ordering prior. Tables which are necessary to carry out the selection procedure with isotonic approach for the selection of unknown means of normal populations and gamma populations are given. Monte Carlo comparisons on the performance of several procedures for the normal or gamma means problem were carried out in selected cases. The procedures based on isotonic estimators always have superior performance, especially, when there are more than one bad populations (in comparison with the control). Dissert. Abstr.

N81-18774 Oklahoma State Univ., Stillwater.
THE ANALYSIS OF STRUCTURAL CHANGES IN TIME SERIES AND MULTIVARIATE LINEAR MODELS Ph.D. Thesis
Diego Salazar 1980 85 p
Avail: Univ. Microfilms Order No. 8103328

Bayesian techniques for detecting the presence of changes in the mean vector of multivariate normal sequences are investigated. These ideas were extended to changes in the regression parameters of multivariate linear regression models and to time series models with general changes in the parameters. A class of transition functions was used to model the nature of the change. The posterior distributions of the shift point and all the unknown parameters were derived for multivariate linear regression models. The posterior distributions for the mean vector and the regression parameters are mixtures of matrix T-distributions, while the posterior distribution for the precision parameters is a mixture of Wishart distributions. The joint posterior distribution for the shift point and the transition parameter was derived by using a gamma prior for the scale parameter and uniform priors for the remaining parameters. The numerical examples indicate the genéral change with gamma = 0 is as accurate as the usual abrupt change. Author

N81-18775# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
A MARKOVIAN PROPERTY FOR TWO-INDEX PROCESSES Ph.D. Thesis - Pierre et Marie Curie Univ., Paris [UNE PROPRIETE MARKOVIENNE POUR LES PROCESSUS A DEUX INDICES]
Pascal Lefort Jun. 1980 55 p refs In FRENCH
(ENST-E-80003) Avail: NTIS HC A04/MF A01

The definition of a Markov property by the two index process raises a number of difficulties due in large measure to the loss of total order. There are numerous ways of delimiting the past, present, and future of a point, or of a group of points, or of sq R. There are also many possible represenations of the Markovian character. Results for the theorem of the monotone class are presented and properties of Markov and Gaussian processes are examined. The properties of Paul Levy for openings of a convex rectangular type are discussed as well as weak Markov processes and the processes of Cairoli. Differential stochastic equations and Markov processes are considered with emphasis on the existence and uniqueness of the solution of an EDS with two indexes. Transl. by A.R.H.

N81-18776# Texas A&M Univ., College Station. Inst. of Statistics.
TIME SERIES MODEL IDENTIFICATION AND PREDICTION VARIANCE HORIZON
Emanuel Parzen Jun. 1980 35 p refs
(Contract N00014-78-C-0599)
(AD-A094315; TR-N-13) Avail: NTIS HC A03/MF A01 CSCL 12/1

An approach to time series modeling is described; it classifies the time into one of three memory types (called no memory, short memory, and long memory), and then finds a whitening filter. When the time series is short memory, one would like to identify the whitening filter type as AR, MA, or ARMA before parameter estimation. A new tool is introduced which can be used to diagnose both the memory type of a time series, and the whitening filter type of a short memory time series. It is called prediction variance horizon function. To classify the model type of a time series, one uses the shape of PVH and the value of the horizon HOR (defined as the smallest value of h for which PVH(h) less than or = 0.05). The analysis of a real time series, called Freeze, is described. GRA

N81-18777# Texas A&M Univ., College Station. Inst. of Statistics.
TIME SERIES FORECASTING BY ARARMA MODELS
Emanuel Parzen Jun. 1980 25 p refs
(Contract N00014-78-C-0599)
(AD-A094409; TR-N-14) Avail: NTIS HC A02/MF A01 CSCL 12/1

The relation between various basic problems of time series analysis is presented. Exponential smoothing methods are developed from the point of view prediction theory and extended. ARARMA models are introduced. Methods of ARARMA model fitting are outlined. Since 'the proof of the pudding is in the eating,' the methods proposed are illustrated using some classic examples of time series, including international airline passengers, Makridakis metals series and sunspots. GRA

N81-18778# Johns Hopkins Univ., Baltimore, Md. Div. of Behavioral Biology.
EVENT TIME-SERIES APPLICATIONS TO THE ANALYSIS OF BEHAVIORAL EVENTS
R. L. Ray, M. J. Nellis, and H. H. Emurian 21 Jan. 1981 34 p refs
(Contract N00014-80-C-0467)
(AD-A094253; TR-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report discusses the application of event time-series techniques to the analysis of a series of behavioral events. These techniques can be used to supplement more traditional methods of data presentation, such as the cumulative record. The event time-series procedures presented involve the estimation of numerical coefficients and the generation of specialized graphical displays which can be used to characterize the complex organizational systems. GRA

N81-18779# Naval Research Lab., Washington, D. C. Systems Research Branch.
EVALUATING THE VALIDATION OF A MONTE CARLO SIMULATION OF BINARY TIME SERIES Final Report
Diego R. Roque 19 Sep. 1980 32 p refs
(AD-A094143; NRL-8427) Avail: NTIS HC A03/MF A01 CSCL 12/1

A statistical technique has been developed for the validation of a Monte Carlo simulation process or other processes whose results can be reduced to a finite time sequence of equally spaced events with dichotomous outcomes. Essential to the technique is the Bahadur-Lazarsfeld representation of the probability distribution of the populations consisting of all binary vectors with a specific number of elements. This paper analyzes the properties of the test and the adequacy of the Bahadur-Lazarsfeld representation for practical application purposes. It examines the probability of rejection which results when the significance level alpha is specified and computes the power of the test when the null hypothesis is tested against known alternatives. The evidence collected suggests that the statistical test is an adequate tool for the purposes for which it was designed. GRA

N81-18780# Georgia Tech Research Inst., Atlanta.
OPTIMUM DESIGNS FOR SECOND ORDER PROCESSES WITH GENERAL LINEAR MEANS Final Report
Marcus Carlton Spruill, III 18 Nov. 1980 4 p
(Contract F49620-79-C-0122; AF Proj. 2304)

(AD-A094577; AFOSR-80-1280TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In the experimentation of any of the sciences, physical, biological, or social there arise situations in which the exact conduct of a specified experiment is under the control of an experimenter. The experimenter must therefore make a decision. Where the conduct of an individual experiment may be costly or where there are a large number of possible experiments a premium is placed upon the quality of this decision. This research was concerned with the selection of the proper experiments when the data are 'time' recordings. Of special interest was data which arise as solutions to linear white noise random differential equations. Approximately optimal designs were effectively characterized for this case. Similar characterizations were shown to hold for partial differential operators and random fields. Work was also begun on the identification of experiments which are robust against departures from the assumed model. Results were obtained for both scalar and 'time' recording data GRA

N81-18781# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOME REMARKS ON THE GAUSSIAN DISCRIMINANT
Lee K. Jones 3 Oct. 1980 15 p refs
(Contract F19628-80-C-0002)
(AD-A094066; TN-1980-47; ESD-TR-80-193) Avail: NTIS HC A02/MF A01 CSCL 12/1

We comment on the performance of the Gaussian discriminant function with (possibly) non-Gaussian underlying distributions. An asymptotic expression for the probability of error for the Gaussian case is given with a formal convergence proof. GRA

N81-18782# Naval Postgraduate School, Monterey, Calif.
TRUNCATION AND ACCEPTANCE RULES FOR SEQUENTIAL TESTS FOR A BERNOULI PARAMETER M.S. Thesis
Juergen Petersen Sep. 1980 129 p
(AD-A094613) Avail: NTIS HC A07/MF A01 CSCL 12/1

In the paper, Wald's Sequential Probability Ratio test for a Bernoulli parameter is studied to assess the influence of truncation on the tree probabilities of error of the first and second kind. It is shown that a natural truncation point exists for every SPR test such that the desired error probabilities are not exceeded. Extended acceptance rules were described whose use allows truncation comparatively early when certain sample sizes are picked. The true error probabilities achieved are either both smaller or equal to the desired ones or one is smaller or equal and the other is exceeded. In the latter case, that probability of error that shall not be exceeded can be chosen and the other will be as small as possible. A listing of 126 SPR plans useful in quality control applications has been included which gives all described truncation points with the applicable acceptance rules and the values for the true probabilities of error. GRA

N81-18783 Cornell Univ., Ithaca, N. Y.
MAXIMUM LIKEHOOD ESTIMATION AND COVARIATE ANALYSIS BASED ON CENSORED SURVIVAL DATA Ph.D. Thesis
Stephen William Mykytyn 1980 97 p
Avail: Univ. Microfilms Order No. 8102994

Generalized maximum likeihood estimators are derived for cumulative distribution functions belonging to the class of increasing failure rate (IFR), decreasing failure rate (DFR) and U-shaped failure rate (UFR) distribution when survival data is subject to various kinds of right censoring. The IFR and DFR estimators are shown to be strongly consistent under mild conditions, and Monte Carlo results indicate good performance relative to competing parametric and nonparametric estimators. Two procedures are proposed for analyzing right-censored survival data with covariates when an increasing proportional hazards models is appropriate. These are studied in detail for the two sample problem. Monte Carlo results shows that one of these procedures performs well relative to the traditional method of analysis. Data from a cancer mortality study are analyzed as an example. Dissert. Abstr.

N81-18784 New York State Univ., Binghamton.
DISCRETE DISCRIMINANT ANALYSIS USING LOG-LINEAR MODELS Ph.D. Thesis
Deborah Lynn Brigham 1981 71 p
Avail: UNiv. Microfilms Order No. 8103048

A procedure for discriminant analysis is developed based on a likelihood ratio approach. The error involved in incorrectly discriminating will be minimized if an unknown observation is classified in the group which has the largest likelihood, i.e., the group which has the largest expected cell frequency for each combination of levels of the discrete variables. The expected cell frequencies are estimated by first finding from the observed data the best log-linear model that reflects the relationships between the variables. The expected cell frequencies are then estimated by minimizing the likelihood function under the best log-linear model. Once the procedure is implemented an estimate of optimal discrimination error is attained by replacing the unknown parameters by their maximum likelihood estimates. Dissert. Abstr.

N81-18785 Purdue Univ., Lafayette, Ind.
ESTIMATION IN A STATISTICAL CONTROL PROBLEM Ph.D. Thesis
Lloyd Mark Berliner 1980 100 p
Avail: Univ. Microfilms Order No. 810629

Let X have a p-variate normal distribution with unknown mean theta and identity covariance matrix. The problem is to choose a decision rule delta (X) subject to incurring a loss L delta, theta = (theta (t)delta-1). This decision problem is shown to be a transformed version of a control problem in which control levels are to be chosen in a linear model so that the resulting dependent random variable is close to a desired value. The admissibility of spherically symmetric generalized Bayes rules is considered. Such rules are shown to be admissible under certain conditions on their corresponding prior densities. The essential condition is that the density be bounded by K absolute value theta (4-p) for absolute value theta large. A general technique for comparing decision rules in terms of risk is introduced. Application of this technique yields results useful in investigating inadmissibility. Classes of rules which dominate standard in admissible rules are presented. The minimaxity of classes of rules is investigated. Rules are derived and evaluated by decision theoretic criteria. Dissert. Abstr.

N81-18786 Purdue Univ., Lafayette, Ind.
ON THE CHOICE OF COORDINATES IN SIMULTANEOUS ESTIMATION OF NORMAL MEANS Ph.D. Thesis
Dipak Kumar Dey 1980 105 p
Avail: Univ. Microfilms Order No. 8102641

Let X be a k variate vector normally distributed with mean theta and known covariance matrix epsilon. Given a set of coordinates, it is known what shrinkage type estimators to use. It is not known, however, what coordinates to use. In the case of estimating theta, the question of choice of coordinates is considered and is called the separation problem, in that one often must decide whether to use all coordinates in one combined shrinkage estimator or separate into groups and use separate shrinkage estimators on each group. The combined and separate estimators generally have risk functions which cross, i.e., the performance of one estimator is better than the other in one region and worse in another region. Therefore, criterion involving Bayes risks are used to decide whether or not to separate. The robust generalized Bayes estimators are considered in estimating the mean in both the combined and the separate problems. Dissert. Abstr.

N81-18787 Oklahoma State Univ., Stillwater.
ESTIMATION ASSOCIATED WITH SAMPLE SURVEYS OF OVERLAPPING SUBPOPULATIONS Ph.D. Thesis
Timothy Craig Coburn 1980 273 p
Avail: Univ. Microfilms Order No. 8103289

An extensive investigation of the statistical problems associated with survey sampling overlapping subpopulations and estimation of their parameters is presented. Specifically addressed as a function of the size of the overlap is the potential for improving the precision of estimates of the parameters of individual subpopulations given fixed samples sizes for the surveys; or conversely, for reducing the the combined total sample size of all the surveys given fixed levels of precision. Examples are presented from the context of the overlapping constituencies of federal welfare programs. A basic overlapping sample surveys design is proposed, on the basis of which some necessary

estimation theory is derived. A new multisample post stratification estimator results, which judiciously combines all the information on the overlap domain available from the surveys of all the subpopulations. Two techniques are established for reducing the combined total sample size of all the surveys when the precision of this new estimator is fixed at some prespecified level.
Dissert. Abstr.

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-18788 Connecticut Univ., Storrs.
NOT NECESSARILY LINEAR SYSTEM THEORY Ph.D. Thesis
Andrew Joseph Fish, Jr. 1980 287 p
Avail: Univ. Microfilms Order No. 8103163

The main results of this dissertation are: (1) a systems form for a class of nonlinear systems; (2) a control theory for the class of nonlinear systems; (3) a system solution in the form of Taylor's formula for the nonlinear system equations and (4) a control theory for bilinear systems. The results are derived from a standard representation of a system called the system normal form which consists of a primitive equation and an output equation. The system normal form has many properties that are intuitively satisfying. It is derived from the equations that are obtained from the physical laws that govern the system. The system normal form maintains the integrity of the solutions of these equations. The system normal form may be written in terms of the physical variables of the system. It incorporates the algebraic properties normally found in the frequency representation of nonlinear systems. The system normal form is unique up to control and is applicable to many types of systems including systems with pure delays, integrators, and differentators.
Dissert. Abstr.

N81-18789 Stanford Univ., Calif.
ON BALANCED REALIZATIONS FOR TIME VARIANT LINEAR SYSTEMS Ph.D. Thesis
Erik Isidoor Verriest 1980 313 p
Avail: Univ. Microfilms Order No. 8103570

Systematic approaches to the analysis and synthesis of linear time varying systems are presented. The time varying system as given by its impulse response is considered. Based on series expansions, approximations of the system are given by a certain canonical parallel combination of subsystems featuring time-invariant dynamics. The realizability of a system from its operational transfer function is discussed. This is derived either directly from the input-output differential equation, or indirectly via the theory of skew polynomial rings. Results on the complete reachability and observability of interconnected time varying systems are obtained. Given a linear system (A(t), B(t), C(t)), different criteria of reachability (controllability) and observability (constructability) are proposed, based on certain input and output gramians. They allow a quantitative interpretation of the input and the output behavior of the system and display the imbalance which may be present.
Dissert. Abstr.

N81-18790 Alabama Univ., University.
STOCHASTIC MULTIPLE OBJECTIVE PROGRAMMING PROBLEMS Ph.D. Thesis
PinChung Chen 1980 94 p
Avail: Univ. Microfilms Order No. 8100563

Multiple objective programming (MOP) problems in which the right hand side of the constraint equations are random variables with known distribution function are studied. A MOP with the property described above is called a stochastic multiple objective programming (SMOP) problem. The mathematical theory as well as a computational algorithm for the SMOP are discussed. The necessary theoretical background for MOP and stochastic programming problems (SPP) are reviewed. An approach to solving a SMOP is established through a two stage process. The convexity and the continuity of the second stage problem are discussed under suitable conditions. Using the concept of point-to-set mapping, the continuity of the optimal value function of the second stage problem is shown by applying Geoffrion's theorems. After the equivalent scalar valued problems for the SMOP are defined, the well known inequalities for the SPP are re-examined in terms of the SMOP.
Dissert. Abstr.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-18791 Stanford Univ., Calif.
A PARAMETRIC ANALYSIS OF STRUCTURED AND UNSTRUCTURED Q-SORT DATA Ph.D. Thesis
William D. Heavlin 1980 75 p
Avail: Univ. Microfilms Order No. 8103517

The operation of sorting the items of a Q-set according to their similarity to a given object is idealized by a system of axioms. As a consequence of this axiom system, a stochastic model of Q-sorting behavior is derived. This model, with its associated axioms, resembles in some respects the preference model of Luce; the two are compared at length. This Q-sort model is easily embedded in an exponential family. The domain of this family is the discrete space of all permutations of the items in the Q-set while its natural parameter space consists of the coefficients of a predictive linear relation. Some empirical methods for deriving a description of the underlying structure of the Q-set are developed in the context of a factor analysis model. The normalizing constant of this exponential family is impossible to compute; the calculation of a useful surrogate for this constant is the primary technical problem discussed. The solution posed considers a conditional likelihood whose normalizing constant is calculated over an intuitively appealing subgroup of permutations. A computer implementation of an algorithm for maximizing such a conditional likelihood model is described.
Dissert. Abstr.

N81-18792 Oregon Univ., Eugene.
MULTIPLICITIES OF PRINCIPAL SERIES REPRESENTATIONS OF FINITE GROUPS OF LIE TYPE Ph.D. Thesis
Kathy McGovern 1980 105 p refs
Avail: Univ. Microfilms Order No. 8102291

Let G be a finite group of Lie type with Coxeter system (W,R). In studying the representation theory of G, it is desirable to view this group as part of an infinite family of groups (G(q)) with the same Coxeter system and parameterized by an infinite set of prime powers (q). One then hopes to obtain results of the representations of all the groups in the family by generic models. Frequently this can be done by expressing results in terms of the Weyl group W, which is independent of the parameters (q). Such a result is proved for multiplicities of principal series representations of finite groups of Lie type. The structures of associated generic algebras and Hecke algebras are also investigated.
Dissert. Abstr.

N81-18793# Maryland Univ., College Park. Computer Vision Lab.
THREE-DIMENSIONAL DIGITAL TOPOLOGY: THE GENUS Interim Report
David G. Morgenthaler Nov. 1980 46 p refs
(Grant AF-AFOSR-3271-77)
(AD-A094339; TR-980; AFOSR-81-0061TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report is one of a series on the geometrical and topological properties of three-dimensional digital images. In this report, we define the genus of a subset of a three-dimensional array and show that the properties of this digital genus are consistent which those of the genus in ordinary (continuous) topology. Since this approach is different from that normally used in two dimensions, we also present the two-dimensional case. The derivation of the three-dimensional genus allows us to make explicit what is meant by a hole in an object (e.g., the hole in a ring). We also give algorithms for computing the three-dimensional digital genus and discuss the importance of three-dimensional genus in contrast with the two-dimensional genus.
GRA

N81-18794 Stanford Univ., Calif.
ENTIRE SPACELIKE HYPERSURFACES OF CONSTANT

MEAN CURVATURE IN MINKOWSKI SPACE Ph.D. Thesis
Andrejs Eriks Treibergs 1980 85 p
Avail: Univ. Microfilms Order No. 8103567

The complete constant mean curvature spacelike hypersurfaces in Minkowski space of arbitrary dimension are described and classified. A method is developed for constructing these hypersurfaces. It is used in building counterexamples to the conjecture that the only such hypersurfaces are the hyperboloids. Curvature estimates are given for constant mean curvature hypersurfaces. Spacelike hypersurfaces in Minkowski space are given by graphs of functions whose gradient has norm less than one. Functions are treated that satisfy the Minkowski space constant mean curvature equation over all of Euclidean space. This is a quasilinear partial differential equation which is elliptic only for spacelike graphs. The projective boundary of an entire solution is defined to be the limiting hypersurface obtained by homothetically contracting the surrounding Minkowski space to a point. It shows that the projective boundaries gotten from entire solutions belong to the set of convex positively homogeneous functions whose gradient has norm one wherever defined.
Dissert. Abstr.

N81-18795 Syracuse Univ., N. Y.
MATROIDS: CONSTRUCTIONS, CLASSIFICATIONS, AND APPLICATIONS Ph.D. Thesis
Wendy Louise Dugnan 1980 184 p
Avail: Univ. Microfilms Order No. 8104521

Definitions and examples of the substructures of which a matroid is composed are presented. Through those examples it is demonstrated that matroid theory is related to several different areas of mathematics. The interrelationships among those substructures are described and questions of existence, uniqueness, and equivalence that arise when one attempts to compare and combine the content of various expositions of matroid theory are answered. A survey is presented of some results of matroid theory, drawn from many sources and illustrating three major aspects of the study of matroid theory; using given matroids to construct new ones, classification of matroids according to certain properties, and applications of matroid theory.
Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-18796# California Univ., Livermore. Lawrence Livermore Lab.
AUTOMATION OF COMPUTATIONAL PHYSICS Ph.D. Thesis
Michael Clarence Wirth Oct. 1980 318 p refs
(Contract W-7405-eng-48)
(UCRL-52996) Avail: NTIS HC A14/MF A01

Software tools based on the algebraic manipulation system MACSYMA that facilitate the design, analysis, and construction of finite difference programs for the numerical solution of systems of partial differential equations are described. Four packages of tools are presented: VECT, FDIFF, FSTAB, and MACTRAN. The VECT package performs symbolic algebra and calculus with vectors and dyadics.
DOE

N81-18797 Ohio Univ., Athens.
NEAR-RESONANT SYTSEMS IN SLOW-FLUCTUATION APPROXIMATION Ph.D. Thesis
Maria Francina Augusteijn 1980 135 p
Avail: Univ. Microfilms Order No. 8103023

Autonomous, conservative, nonlinear oscillatory systems of many degrees of freedom with an internal resonance, i.e., with the linearized ('normal') frequencies tied in a near resonant relation Sigma g sub i omega sub i = epsilon are considered. A transparent approximation is made which is a variant of the method of slowly variable amplitude and phase. It consists of developing the nonlinear coupling into a trigonometric polynomial and neglecting all terms except the most slowly varying ones on the ground that their perturbative effects are oscillatory but essentially not cumulative. In this slow-fluctuation technique, the amplitudes separate off the phases; they exhibit joint extrema governed by simple conservation laws and all follow from one single quadrature. The phases also require no more than quadratures. Among the various possibilities of motion there are classes in which all amplitudes remain constant; the degrees of freedom then exhibit harmonic time variation at (generally) incommensurate frequencies.
Dissert. Abstr.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-18798*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
FORWARD VELOCITY EFFECTS ON FAN NOISE AND THE SUPPRESSION CHARACTERISTICS OF ADVANCED INLETS AS MEASURED IN THE NASA AMES 40 BY 80 FOOT WIND TUNNEL: ACOUSTIC DATA REPORT Final Report
Michael T. Moore Jan. 1981 262 p refs
(Contract NAS2-8675)
(NASA-CR-152329) Avail: NTIS HC A12/MF A01 CSCL 20A

Forward velocity effects on the forward radiated fan noise and on the suppression characteristics of three advanced inlets relative to a baseline cylindrical inlet were measured in a wind tunnel. A modified JT15D turbofan engine in a quiet nacelle was the source of fan noise; the advanced inlets were a CTOL hybrid inlet, an STOL hybrid inlet, and a treated deflector inlet. Also measured were the static to flight effects on the baseline inlet noise and the effects on the fan noise of canting the baseline inlet 4 deg downward to simulate typical wing mounted turbofan engines. The 1/3 octave band noise data from these tests are given along with selected plots of 1/3 octave band spectra and directivity and full scale PNL directivities. The test facilities and data reduction techniques used are also described.
M.G.

N81-18799*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
ANALYTICAL PREDICTION OF THE INTERIOR NOISE FOR CYLINDRICAL MODELS OF AIRCRAFT FUSELAGES FOR PRESCRIBED EXTERIOR NOISE FIELDS. PHASE 1: DEVELOPMENT AND VALIDATION OF PRELIMINARY ANALYTICAL MODELS
L. D. Pope, D. C. Rennison, and E. G. Wilby Oct. 1980 225 p refs
(Contract NAS1-15782)
(NASA-CR-159363; BBN-4420) Avail: NTIS HC A10/MF A01 CSCL 20A

The basic theoretical work required to understand sound transmission into an enclosed space (that is, one closed by the transmitting structure) is developed for random pressure fields and for harmonic (tonal) excitation. The analysis is used to predict the noise reducton of unpressurized unstiffened cylinder, and also the interior response of the cylinder given a tonal (plane wave) excitation. Predictions and measurements are compared and the transmission is analyzed. In addition, results for tonal (harmonic) mechanical excitation are considered.
A.R.H.

N81-18800*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POSTFLIGHT ANALYSIS OF THE SINGLE-AXIS ACOUSTIC SYSTEM ON SPAR VI AND RECOMMENDATIONS FOR FUTURE FLIGHTS
R. J. Naumann, W. A. Oran, Roy R. Whymark (Intersonics, Inc.), and Charles Rey (Intersonics, Inc.) Jan. 1981 35 p
(NASA-TM-82396) Avail: NTIS HC A03/MF A01 CSCL 20A

The single axis acoustic levitator that was flown on SPAR VI malfunctioned. The results of a series of tests, analyses, and investigation of hypotheses that were undertaken to determine the probable cause of failure are presented, together with recommendations for future flights of the apparatus. The most probable causes of the SPAR VI failure were lower than expected sound intensity due to mechanical degradation of the sound

source, and an unexpected external force that caused the experiment sample to move radially and eventually be lost from the acoustic energy well. A.R.H.

N81-18801*# National Aeronautics and Space Administration, Washington, D. C.
THE FRENCH METHOD (OF REPRESENTING NOISE ANNOYANCE)
Francois Collet and Jacques Delol Jun. 1980 16 p Transl. into ENGLISH from Voies-Aviation Civile (France), Fall-Winter 1979 p 10-13 Original language doc. announced as A80-21960 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-75833) Avail: NTIS HC A02/MF A01 CSCL 20A

The psophic index used in France for noise exposure from aircraft globally represents the annoyance with the following hypotheses: (1) the global annoyance is a function of the number of aircraft overflights of each type but does not depend on the overflight time; (2) an aircraft flying at night is considered to be just as annoying as 10 aircraft of the same type passing overhead during the day; and (3) and annoyance is only a function of the peak noise levels. Overall, the psophic index appears statistically as good a representation of the average annoyance as methods used in other countries; however, it does seem to reflect poorly the annoyance caused by light aircraft. Noise maps produced for Orly, Roissy, and the area around Paris are described. The range of applications and limitations of the psophic index are discussed. A.R.H.

N81-18802# Centre Technique des Industries Mecaniques, Senlis (France).
HEURISTIC PROGRAMMING FOR AUTOMATIC CONTROL BY ULTRASOUND [LA PROGRAMMATION HEURISTIQUE POUR LE CONTROLE AUTOMATIQUE PAR ULTRASONS]
P. Moulin and Y. Pralus Dec. 1979 30 p In FRENCH
(CETIM-15.H.26.0) Avail: NTIS HC A03/MF A01

Procedures for automatic control were studied using a transducer with two degrees of freedom to develop research algorithms and characterize defects. Small surface defects were examined to estimate their favored direction. The characterization of a target surface, sweeping on a sphere cut into 16 sections, the iteration of cylindrical and conical sweepings, and the iteration of small surface flaw are described. The study was completed in two stages in order to treat separately problems related to displacement of the transducer in space, and problems related to acoustic refraction. Transl. by A.R.H.

N81-18803# Institut Franco-Allemand de Recherches, St. Louis (France).
INFLUENCE OF A GASEOUS ENVELOPE ON THE NOISE OF A FREE SUPERSONIC JET [INFLUENCE D'UNE ENVELOPE GAZEUSE SUR LE BRUIT D'UN JET SUPERSONIQUE LIBRE]
G. Patz 25 May 1979 36 p refs In FRENCH
(Contract T/R-760/80030/83756)
(ISL-R-110/79) Avail: NTIS HC A03/MF A01

The acoustic field of a free supersonic jet is constituted essentially by Mach waves issued from structures appearing in the jet boundary layer. By creating a gas envelope with a higher acoustic velocity around the jet, the formation of Mach waves is prevented. Free jets with an outlet diameter of 10 mm and Mach number of 1.5, 2.0, and 3.0 were produced in a shock tube and surrounded by an envelope of helium with a density varying from 0.5 mm to 5 mm, corresponding to different flows. Differential interferometry shows that, with envelopes of weak density the length of the cone, Mach waves were displaced downstream. A zone without Mach waves was found upstream. Complete suppression of Mach waves occurs when the gas envelope attains the order of magnitude of the diameter of the jet. Analysis of the pressure field of the cone of Mach waves by Mach-Zehnder interferometry in laser light showed that, in relation to a jet without a gas envelope, the lines of constant amplitude of pressure fluctuations were displaced downstream under the influence of a gaseous envelope. A simple coordinate transformation the length of the jet axis shows agreement with measures obtained using an empirical formula. Transl. by A.R.H.

N81-18804# Engins Matra, Velizy (France). Dept. Espace.
SURFACE ACOUSTIC WAVE (SAW) DEVICES [LES DISPOSITIFS A ONDES ELASTIQUES DE SURFACE (SAW)]
E. Rabeyrin, ed. 16 May 1980 19 p refs In FRENCH
(DX-70/0.215) Avail: NTIS HC A02/MF A01

Surface acoustic wave devices use the properties of certain piezoelectric materials to propagate a signal, a propagation whose velocity can be modified by the presence of a metal on the surface. The operating principles of these devices are described and some examples of applications are presented to explain the great interest in their use in the high frequency domain. Topics covered include Rayleigh waves, substrates, characteristics of a transducer, and reliability. Applications considered include delay signs, lines, memory lines, filters, oscillators, and resonators. The fabrication of surface acoustic wave devices is also mentioned. Transl. by A.R.H.

N81-18805# Texas Univ. at Austin. Applied Research Labs.
SOME SIMPLE PROPAGATION MODELS FOR LINEAR AND PARAMETRIC SOURCES IN SHALLOW WATER
T. G. Muir 9 Apr. 1980 20 p refs
(Contract N00014-75-C-0161)
(AD-A094060; ARL/TR-80-22) Avail: NTIS HC A02/MF A01 CSCL 20/1

An existing theory is extended to model the average field of sound propagating from directive sources in a shallow water waveguide. The role of narrow beam sources in the excitation of modes is explored. Sample calculations are given. GRA

N81-18806# Naval Ocean Systems Center, San Diego, Calif. Environmental Acoustic Div.
VERIFICATION OF THE ADIABATIC INVARIANT APPROXIMATION FOR COMPUTING EFFECTIVE HORIZONTAL SOUND SPEEDS IN A RANGE DEPENDENT ENVIRONMENT Interim Report, Apr. - Sep. 1980
J. Northrop, R. C. Shockley, and P. G. Hansen Sep. 1980 22 p refs
(AD-A094454; NOSC/TR-621) Avail: NTIS HC A02/MF A01 CSCL 20/1

Use of the Adiabatic Invariant Approximation (AIA) for determining horizontal sound speeds in a range dependent environment was proposed. Because the method provides a great savings in computer time over conventional ray tracing techniques, it was applied to two very-long-range paths, from Perth, Australia, to Bermuda and to Fernando de Noronha (19763.0 and 14549.3 km, respectively), where measured travel times are available. Results show that the AIA method predicts effective horizontal sound speeds of 1482.3m/s and 1480.4m/s, respectively, for the two propagation paths. These results compare favorably with the measured values of 1484.7 - or - 3.7 m/s and 1480.1 + or - 0.9 m/s. GRA

N81-18807# Rockwell International Corp., Golden, Colo. Rocky Flats Plant.
EVALUATION OF ULTRASONIC SIGNALS FROM DIFFUSION AND EUTECTIC BOND INTERFACES
Charles M. Brown 10 Dec. 1980 25 p
(Contract DE-AC04-76DP-03533)
(RFP-2964) Avail: NTIS HC A02/MF A01

A research program is in progress at Rocky Flats to determine correlations between ultrasonic signal content and diffusion or eutectic bond joint condition, and to develop a computer-controlled scanning, data acquisition and analysis system which utilizes these correlations and waveform analysis techniques. The initial efforts to determine effective ultrasonic waveform parameters to characterize the strength of bond interfaces is complete. A development version of a computer-controlled, automated scanning and data acquisition system is in operation. DOE

N81-18808 California Univ., Los Angeles.
FLAP NOISE CHARACTERISTICS MEASURED BY PRESSURE CROSS CORRELATION TECHNIQUES Ph.D. Thesis
Wendell Roger Miller 1980 289 p
Avail: Univ. Microfilms Order No. 8104022

The aerodynamic sound generated by a realistic aircraft flap system was investigated through the use of cross correlations between surface pressure fluctuations and far field sound.

Measurements were conducted in two subsonic wind tunnel studies to determine the strength, distribution, and directivity of the major sources of flap noise at speeds up to 79.0 m/sec. A pilot study was performed on a single flap model to test the measurement technique and provide initial data on the characteristics of flap noise. The major portion of this investigation studied the sound radiated by a realistic large scale model of a triple slotted flap system mounted on a sweptback 6.7 meter semispan model wing. The results of this investigation have identified the major sources of flap generated noise and their dependence of flow defining parameters. In addition, a possible avenue toward the reduction of flap generated noise has been identified via the placement of the flap actuator fairings on the flap system.
Dissert. Abstr.

N81-18809 Purdue Univ., Lafayette, Ind.
ACOUSTICAL MODELING OF AUTOMOTIVE EXHAUST SYSTEMS Ph.D. Thesis
Marehalli Gopalan Prasad 1980 218 p
Avail: Univ. Microfilms Order No. 8102697

The performance of automotive exhaust muffler systems was studied using an acoustical model based on electrical analogue. The various types of performance descriptions studied were transmission loss, noise reduction, insertion loss and radiated sound pressure level for both without and with a mean flow. The prediction schemes developed are verified on both a model exhaust system and a multicylinder engine exhaust system. Among the studies conducted on the model exhaust system, transmission loss and noise reduction was predicted and measured using both the standing wave technique and the random excitation technique. The source impedance of an electroacoustic driver was measured using the two microphone random excitation technique. Insertion loss and radiated sound pressure level were predicted by using the (measured) source impedance and compared with experimental results for various model exhaust system configurations. It was observed that provided the measured source impedance is used, the performance can be predicted quite well. Dissert. Abstr.

N81-18810 Rensselaer Polytechnic Inst., Troy, N. Y.
MATHEMATICAL ANALYSIS OF DEEP-OCEAN ACOUSTICAL EFFECTS OF RECEIVER AND SOURCE MOTIONS AT SHORT AND INTERMEDIATE RANGES Ph.D. Thesis
James Lee Kays 1980 148 p
Avail: Univ. Microfilms Order No. 8103759

Using ray theory, analyses are presented for constant depth motions for both short and intermediate ranges and the effects of depth varying source motion are examined at short ranges. General results for the effects of both receiver and source motions on a CW signal transmitted through a deep ocean channel at short ranges were determined using a bilinear sound speed profile. Time dependent expressions for the total field amplitude and phase were developed for appropriately limited time intervals. Numerical results are presented. General analytical expressions for the total field were derived and provide the basis for a study of the acoustical effects of varying motion parameters and initial range. It is demonstrated that effects of differences in range on total field phase rate and the time interval between amplitude maxima are significant at short ranges and diminish as range increases. Effects on total field due to receiver motion are shown to be both significant and widely varying depending on receiver and source directions and speeds. The combined effects of time dependent changes in source depth and receiver source range are discussed for a CW signal transmitted over relatively short ranges. Dissert. Abstr.

N81-17999*# General Electric Co., Cincinnati, Ohio.
VCE EARLY ACOUSTIC TEST RESULTS OF GENERAL ELECTRIC'S HIGH-RADIUS RATIO COANNULAR PLUG NOZZLE
Paul R. Knott, J. F. Brausch, P. K. Bhutiani, R. K. Majjigi, and V. L. Doyle *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 417-452 refs (For primary document see N81-17981 09-01)
(Contracts NAS3-20582; NAS3-21608)
Avail: NTIS HC A23/MF A01 CSCL 20A

N81-18000*# Douglas Aircraft Co., Inc., Long Beach, Calif.
FLIGHT AND TUNNEL TEST RESULTS OF THE MDC MECHANICAL JET NOISE SUPPRESSOR NOZZLE
R. D. FitzSimmons, R. A. McKinnon, and E. S. Johnson *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 453-478 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 20A

N81-18001*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF NOZZLE DESIGN ON THE NOISE FROM SUPERSONIC JETS
John M. Seiner, Thomas D. Norum, and Lucio Maestrello *In its* Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 479-491 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 20A

N81-18002*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF NOISE TECHNOLOGY FOR ADVANCED SUPERSONIC CRUISE AIRCRAFT
James R. Stone and Orlando A. Gutierrez *In* NASA. Langley Research Center Supersonic Cruise Res. 1979, Pt. 1 Mar. 1980 p 493-518 refs (For primary document see N81-17981 09-01)
Avail: NTIS HC A23/MF A01 CSCL 20A

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-18811 South Carolina Univ., Columbia.
VIBRATIONAL SPECTRA, MOLECULAR STRUCTURE AND CONFORMATIONAL ANALYSIS OF SOME MOLECULES WITH ANHARMONIC VIBRATIONS Ph.D. Thesis
Dennis Jay Gerson 1980 187 p
Avail: Univ. Microfilms Order No. 8102762

Raman and/or infrared spectra are reported for: (1) gaseous, liquid, and solid 2 methyl-1-butene and 3 methyl-1-butene; (2) gaseous 2 methyl-2-butene; (3) liquid and solid ethylvinylether; (4) aqueous L casei dihydrofolate reductase; and (5) gaseous liquid and solid Cl3SiNCO and Cl3SiNCS. Dissert. Abstr.

N81-18812# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ELABORATION OF AN EXPERIMENT FOR SUPERELASTIC DIFFUSION OF Li(+) IONS IN THE PRESENCE OF A NO JET Thesis [AUFBAU EINER ANORDNUNG ZUR SUPERELASTISCHE STREUUNG VON Li IONEN AN EINEN NO DUESENSTRAHL]
Michael Wilde Dec. 1979 159 p refs In GERMAN
(MPIS-25/1979; ISSN-0346-1199) HC A08/MF A01

The results of the time of flight measurements do not indicate the superelastic scattering by the vibration stimulated NO molecules as expected. Although the time of flight distribution has a poor signal to noise ratio, it is concluded that due to the chosen experimental conditions, the scattering center stimulated vibrations of the NO molecular rays are so small, that the time of flight spectrum has no distinct influence. E.D.K.

N81-18813# California Univ., Berkeley.
LOWER-HYBRID DRIFT INSTABILITY SATURATION MECHANISMS IN ONE-DIMENSIONAL SIMULATIONS
Y.-J. Chen and C. K. Birdsall 19 Sep. 1980 37 p refs
(Contract N00014-77-C-0578)
(AD-A094289; UCB/ERL-M80/40) Avail: NTIS HC A03/MF A01 CSCL 12/1

The linear properties and saturation mechanisms of the lower-hybrid drift instability have been investigated using a one-dimensional particle-hybrid simulation. For low drift velocities (V sub d much less than V sub ti), ion trapping and current relaxation (V sub d approaches limit of 0) are competing processes for stabilization. If the relative electron-ion drift velocity is kept constant in time, ion trapping causes the end of instability growth; if this drift is allowed to decrease consistent with

momentum balance, then saturation is due to current relaxation. GRA

N81-18814# Battelle Columbus Labs., Ohio. Physical Sciences Sect.

MOLECULAR INTERACTIONS WITH MANY-BODY PERTURBATION THEORY Annual Technical Report

Rodney J. Bartlett 15 Sep. 1980 95 p refs
(Grant AF-AFOSR-3661-78; AF Proj. 2301)
(AD-A094512; AFOSR-81-0009TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

Binding energies including valence shell electron correlation were obtained from many-body perturbation theory (MBPT) for diborane, borane carbonyl, and borzane. Results were obtained for basis sets of double zeta quality and for basis sets with polarization functions added on all atoms. The binding energies were found to be (respectively) 35, 21, and 30 kcal/mole. Correlation effects account for 48, 62, and 32 percent of the binding. The size consistent nature of the MBPT method enables the computation of enthalpies of reaction for four different reactions involving monoborane, diborane, carbon monoxide, and borane carbonyl. When the theoretical values are corrected for vibrational zero point energies and the experimental data are adjusted for temperature effects, the results agree (within 5 percent) and thus confirm the set of experimental enthalpies for the association reaction yielding diborane. The result for the binding energy of borazane constitutes a prediction in the absence of an experimental value. GRA

N81-18815# Battelle Columbus Labs., Ohio. Chemical Physics Group.

COMPUTATIONAL STUDY OF NONADIABATIC EFFECTS IN ATOM MOLECULE REACTIVE SCATTERING Final Report

Michael J. Redmon 10 Dec. 1980 114 p refs
(Contract F49620-79-C-0050; AF Proj. 2303)
(AD-A094511; AFOSR-81-0007TR) Avail: NTIS HC A06/MF A01 CSCL 07/4

This report describes a research program that attempts to bring together the computational tools necessary for studying nonadiabatic transitions in atom diatomic molecule collisions. Recent results, including rate constants for state-to-state reactions are presented. Systematic approaches to fitting potential energy surfaces obtained from ab initio quantum chemistry are investigated. A practical formalism for accurately treating nonadiabatic electronic couplings is developed and tested in an application to electronic quenching in K-H collisions. It is argued that these developments provide the theoretical tools necessary for a computational study of rotational, vibrational and electronic transitions in selected atom diatomic molecule reactions. GRA

N81-18816# RAND Corp., Santa Monica, Calif.

FASTER-THAN-LIGHT PARTICLES: A REVIEW OF TACHYON CHARACTERISTICS Interim Report

Edward A. Puscher Oct. 1980 45 p refs
(Contract F49620-77-C-0023)
(AD-A094529; RAND/N-1530-AF) Avail: NTIS HC A03/MF A01 CSCL 20/8

This report documents an analytical prediction of some of the characteristics which presently undiscovered faster-than-light sub-atomic particles (called tachyons) must possess if they are to exist without violating the Theory of Special Relativity. A brief review of necessary concepts from the Special Theory is included so that the reader might more readily understand the reasoning as it is developed. Necessary, but not all characteristics of tachyons are then identified and presented. Finally, an interesting potential relationship between tachyons and anti-gravity is discussed. GRA

N81-18817# Naval Research Lab., Washington, D. C. Thermostructural Materials Branch.

THE NRL-EPRI RESEARCH PROGRAM (RP886-2), EVALUATION AND PREDICTION OF NEUTRON EMBRITTLEMENT IN REACTOR PRESSURE VESSEL MATERIALS. PART 1: DYNAMIC C SUB V, PCC SUB V Annual Progress Report, 1979

J. R. Hawthorne, ed. 31 Dec. 1980 35 p refs
(AD-A094067; NRL-MR-4431-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 18/10

Nuclear reactor pressure vessel materials are subject to progressive reductions in fracture resistance in service due to neutron irradiation. Current technology is inadequate to quantitatively predict radiation embrittlement for all vessel materials and their metallurgical variations for the neutron fluences of interest. In addition, a relationship between apparent notch ductility and fracture toughness in the irradiated condition is needed to evolve more quantitative projections of structural integrity. The NRL-EPRI RP886-2 Program was formulated to advance both areas for the benefit of reactor vessel design and operation. Its primary objective is the development of a high quality data base for evaluation of current radiation embrittlement projection methods and the development of improved methods. This report documents program highlights and research results for CY 1979 along with plans for the completion of program investigations. Postirradiation test data are presented for plate, forging and weld deposit materials irradiated in six reactor experiments to fluences ranging from approx. 0.1 to approx. 10 to the 19th power n/sq cm = 1 MeV at 288 C. Comparisons are made between results for standard Charpy V-notch and fatigue precracked Charpy-V tests of preirradation and postirradiation material conditions. A companion document (Annual Progress Report for CY 1979: Part II) will present results for the 25.4 mm compact toughness (J-R curve) tests of the same materials and material conditions. A preliminary correlation of the Charpy-V and J-integral fracture toughness property changes with irradiation is observed. GRA

N81-18818# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

MOLECULAR-ORBITAL MODELS FOR THE CATALYTIC ACTIVITY AND SELECTIVITY OF COORDINATIVELY UNSATURATED PLATINUM SURFACES AND COMPLEXES Interim Report

A. C. Balazs and K. H. Johnson 31 Dec. 1980 42 p refs
(Contract N00014-75-C-0970; Grant NSF DMR-76-80895)
(AD-A094062; Rept-12) Avail: NTIS HC A03/MF A01 CSCL 07/4

Electronic structures have been calculated for 5-, 6-, and 10-atom Pt clusters, as well as for a Pt(PH3)4 coordination complex, using the self-consistent-field X-alpha scattered-wave (SCF-X-alpha-SW) molecular-orbital technique. The 10-atom cluster models the local geometry of a flat, unreconstructed Pt(100) surface, while the 5- and 6-atom clusters show features of a stepped Pt surface. Pt(PH3)4 resembles the chemically similar homogeneous catalyst Pt(PPh3)4. Common to all these coordinatively unsaturated complexes are orbitals lying near or coinciding with the highest occupied molecular orbital ('Fermi level') which show pronounced d lobes pointing directly into the vacuum. Under the hypothesis that these molecular orbitals are mainly responsible for the chemical activities of the above species, one can account for the relative similarities and differences in catalytic activity and selectivity displayed by unreconstructed Pt(100) surfaces, stepped Pt surfaces or particles, and isolated Pt(PPh3)4 coordination complexes. The relevance of these findings to catalyst-support interactions is also discussed. Finally, relativistic corrections to the electronic structures are calculated and their implications on catalytic properties discussed. GRA

N81-18819# Indiana Univ. at Bloomington. Dept. of Chemistry.

SATURATION OF ENERGY LEVELS IN ANALYTICAL ATOMIC FLUORESCENCE SPECTROMETRY 2, EXPERIMENTAL Interim Technical Report

Dorys Rojas de Olivares and Gary M. Hieftje 30 Jan. 1981 59 p refs
(Contract N00014-76-C-0838)
(AD-A094469; TR-34) Avail: NTIS HC A04/MF A01 CSCL 07/4

A theoretical model was proposed to describe the saturation of atomic energy levels under conditions of intense but brief irradiation by a suitable excitation source. The experimental verification of that model is presented herein. In this study, the effects on dye laser-induced saturation of analyte concentration, flame composition and atomic properties of the elements were all examined and quantitated in terms of a measurable parameter, the saturation spectral power density (SSPD). The results of those studies reveal that SSPD is relatively independent of

analyte concentration and flame composition but is a strong function of the nature of each particular atomic transition employed. Moreover, because of strong quenching in most analytical flames, a simple steady-state model for saturation applies even for brief, 5.6 ns. pulses from a nitrogen-laser pumped dye laser. Most importantly, it is shown that reliable values for the SSPD can be obtained only through careful experimental design; considerations important in such measurements are therefore carefully detailed. GRA

N81-18820# Texas A&M Univ., College Station.
ION-ATOM COLLISIONS Final Report, 1 Sep. 1979 - 30 Nov. 1980
J. F. Reading and A. L. Ford 19 Dec. 1980 27 p refs
(Contract N00014-79-C-0766)
(AD-A093978) Avail: NTIS HC A03/MF A01 CSCL 07/4

Theoretical studies of ion-atom collisions in the intermediate energy range have been carried out. Detailed comparisons to experimental measurements of the inner shell processes of ionization and charge transfer have been made. GRA

N81-18821# Brookhaven National Lab., Upton, N. Y.
NEGATIVE IONS AS A SOURCE OF LOW ENERGY NEUTRAL BEAMS
J. H. Fink 1980 7 p refs Presented at the 2nd Intern. Symp. on Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N.Y., 6-10 Oct. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28703; CONF-801068-15) Avail: NTIS HC A02/MF A01

Little consideration has been given to the impact of recent developments in negative ion source technology on the design of low energy neutral beam injectors. However, negative ion sources of improved operating efficiency, higher gas efficiency, and smaller beam divergence will lead to neutral deuterium injectors, operating at less than 100 keV, with better operating efficiencies and more compact layouts than can be obtained from positive ion systems. DOE

N81-18822# Brookhaven National Lab., Upton, N. Y.
SIMPLE, EFFICIENT NEUTRALIZER FOR D(-) IONS
J. H. Fink and K. Prelec (Westinghouse Electric Corp.) 1980 14 p refs Presented at the 2nd Intern. Symp. on the Production and Neutralization of Negative Hydrogen Ions and Beams, Upton, N.Y., 6-10 Oct. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28702; CONF-801068-14) Avail: NTIS HC A02/MF A01

A simple deuterium gas cell is described to serve as a neutralizer for negative hydrogen ions in the energy range above 40 keV/nucleon. Neutralization efficiency and cell parameters are calculated as function of energy, for a single cell as well as for a two-cell scheme. It is shown that values above 60 percent are possible in the single cell system and about 75 percent in the two-cell system. DOE

N81-18823# Oak Ridge National Lab., Tenn.
LIQUID ARGON AS AN ELECTRON/PHOTON DETECTOR IN THE ENERGY RANGE OF 50 MeV TO 2 GeV: A MONTE CARLO INVESTIGATION
M. S. Goodman, G. Denis, M. Hall, A. Karpovsky, R. Wilson, T. A. Gabriel, and B. L. Bishop Dec. 1980 42 p refs Presented at the IEEE Nucl. Sci. Symp., Orlando, Fla., 5 Nov. 1980
(Contract W-7405-eng-26)
(ORNL/TM-7556; CONF-801103-10) Avail: NTIS HC A03/MF A01

Monte Carlo techniques which are used to study the characteristics of a proposed electron/photon detector based on the total absorption of electromagnetic showers in liquid argon are investigated. The energy range studied was 50 MeV to 2 GeV. Results are presented on the energy and angular resolution predicted for the devices, along with the detailed predictions of the transverse and longitudinal shower distributions. Comparisons are made with other photon detectors, and possible applications are discussed. DOE

N81-18824# Oak Ridge National Lab., Tenn.
PRODUCTION OF HIGH-Q IONS BY LASER BOMBARDMENT METHOD
R. A. Phaneuf 1980 4 p refs Presented at 6th Conf. on Appl. of Accelerators in Res. and Ind., Denton, Tex., Nov. 1980
(Contract W-7405-eng-26)
(CONF-801111-30) Avail: NTIS HC A02/MF A01

The expanding plasma produced when an intense pulse of laser radiation is focused in vacuum onto a solid target was used as a source of highly stripped ions for collision cross-section measurements. Usable fluxes of carbon nuclei at energies of a few hundred eV/charge were obtained by irradiation of graphite with pulses of CO2 laser radiation at a focused power density of 3 x 10(10) W/sq cm. Bombardment of aluminum and iron targets at comparable power levels have yielded ions of maximum charges of 9 and 16, respectively. A time-of-flight apparatus was constructed to utilize the laser source for measurement of electron capture cross sections for highly stripped ions in gases at energies in the few hundred eV/charge range. Apertures collimate an ion beam from the plasma blowoff, and an electrostatic analyzer selects ions from the expanding plasma which have the same energy per charge. The beam is directed through a gas target cell, charge analyzed once more by deceleration, and detected by a channel plate electron multiplier used in a current amplification mode. DOE

N81-18825# Houston Univ., Tex.
K-MESON EXPERIMENTS
E. V. Hungerford 1980 10 p refs Presented at the Intern. Conf. on the Few Body Probl., Eugene, Ore, 17-23 Aug. 1980
(Contract DE-AS05-76ER-03948)
(CONF-800829-10) Avail: NTIS HC A02/MF A01

A brief review of the status of K-meson interactions with nuclei is presented. Emphasis is placed on 1s shell nuclei with representative examples drawn from experiments on heavier nuclear systems. Directions for future developments are discussed. DOE

N81-18826# Argonne National Lab., Ill. Radiological and Environmental Research Div.
CROSS SECTIONS FOR ELECTRON INELASTIC COLLISIONS WITH ARGON
E. Eggarter and M. Inokuti Jul. 1980 33 p refs
(Contract W-31-109-eng-38)
(ANL-80-58) Avail: NTIS HC A03/MF A01

A complete set of optical oscillator strengths and electron-impact cross sections for the argon atom is presented in tabular form. A large variety of experimental data and theoretical calculations was studied and various checks based on theory (including the constraint of sum rules) were critically performed. Data were analyzed mainly by a semiempirical method that stresses the close relation of photoabsorption with electron-atom collisions. DOE

N81-18827# Brookhaven National Lab., Upton, N. Y. Physics Dept.
HIGH GAIN MICRO-CHANNEL PLATE MULTIPLIERS FOR PARTICLE TRACKING OR SINGLE PHOTO-ELECTRON COUNTING
K. Oba (Hsmamatsu TV Co., Ltd., Japan), P. Rehak, and S. D. Smith 1980 7 p refs Presented at the IEEE Nucl. Sci. Symp. Orlando, Fla., 5-7 Nov. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28610; CONF-801103-31) Avail: NTIS HC A02/MF A01

Micro-channel plate multipliers were used to detect the passage of relativistic charged particles. Measurements of the detection efficiency and pulse height response versus micro-channel plate gain are presented for one, two and three micro-channel plate arrays. Values describing temporal response and transit time jitter are also given. In a separate measurement, the response of a single micro-channel plate to individual slow electrons (less than or equal to 1 keV) was studied. By using a special technique output bunches as small as three electrons may be seen for low average micro-channel plate gain. The results of attempts to improve the micro-channel plate response are also presented. DOE

N81-18828# Brookhaven National Lab., Upton, N. Y.
QUARK FLAVOR MIXING AND ITS PHYSICAL IMPLICATIONS

Ling-Lie Chau Wang 1980 7 p refs Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wisc., 17-23 Jul. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28630; CONF-800724-60) Avail: NTIS HC A02/MF A01

Developments on the subject of flavor mixing, especially the Kobayashi-Maskawa model, are reviewed. Aspects discussed include the following: history of the development of the understanding of weak interaction quark states, the determination of the mixing matrix V, nonleptonic decays (the DELTA I = 1/2 rule of K decays, charm nonleptonic decays), the neutron electric dipole moment, decay interference from CP violation, dynamical origin of the quark flavor mixing, and alternatives to the three doublet model. DOE

N81-18829# Fermi National Accelerator Lab., Batavia, Ill.
PHOTON STRUCTURE FUNCTION
William A. Bardeen Nov. 1980 9 p refs Presented at the Intern. Summer Inst. on Theoret., Bad Honnef, Germany, 1-12 Sep. 1980
(Contract DE-AC02-76CH-03000)
(FERMILAB-CONF-80/93-THY) Avail: NTIS HC A02/MF A01

Theoretical understanding of the photon structure function is reviewed. As an illustration of the pointlike component, the parton model is briefly discussed. However, the systematic study of the photon structure function is presented through the framework of the operator product expansion. Perturbative quantum chromodynamics (QCD) is used as the theoretical basis for the calculation of leading contributions to the operator product expansion. The influence of higher order QCD effects on these results is discussed. Results for the polarized structure functions are discussed. Author

N81-18830# Los Alamos Scientific Lab., N. Mex.
PHOTODETACHMENT OF RELATIVISTIC IONS
J. B. Donahue, P. A. M. Gram, M. E. Hamm, R. W. Hamm, H. C. Bryant, K. B. Butterfield, D. A. Clark, C. A. Frost, and W. W. Smith 1980 5 p refs Presented at the 6th Conf. on Appl. of Accelerators in Res. and Ind., Denton, Tex., 3-5 Nov. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3130; CONF-801111-9) Avail: NTIS HC A02/MF A01

A series of fundamental laser ion beam experiments were made feasible by the high quality, relativistic (BETA = 0.842) H(-) ion beam. The relativistic Doppler shift of the light from an ordinary ultraviolet laser provides what is, in effect, a continuously tunable vacuum-ultraviolet laser in the rest frame of the moving ions. The Lorentz transformation of a modest laboratory magnetic field provides an electric field of several megavolts/centimeter. The results of photodetachment work with H(-) beams and spectroscopic work with H(0) beams are presented. DOE

N81-18831# Brookhaven National Lab., Upton, N. Y.
INTERACTIONS OF MULTIPLY-CHARGED IONS WITH ELECTRONS AND PHOTONS
D. C. Gregory, B. M. Johnson, and K. W. Jones 1980 5 p refs Presented at 6th Conf. on Appl. of Accelerators in Res. and Ind., Denton, Tex., 3-5 Nov. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28617; CONF-801111-34) Avail: NTIS HC A02/MF A01

The status of ion beam excitation and ionization by high energy electrons and photons is discussed. Advances in multiply charged ion source development are mentioned, and plans for electron-ion and synchrontron-ion crossed beam experiments are described. DOE

N81-18832# Los Alamos Scientific Lab., N. Mex.
MINIMIZING THE COST OF SPLITTING IN MONTE CARLO RADIATION TRANSPORT SIMULATION
R. J. Juzaitis Oct. 1980 293 p refs
(Contract W-7405-eng-36)
(LA-8546-T) Avail: NTIS HC A13/MF A01

A deterministic analysis of the computational cost associated with geometric splitting/Russian roulette in Monte Carlo radiation transport calculations is presented. Appropriate integro-differential equations are developed for the first and second moments of the Monte Carlo tally as well as time per particle history, given that splitting with Russian roulette takes place at one (or several) internal surfaces of the geometry. The equations are solved using a standard S/sub n/ (discrete ordinates) solution technique, allowing for the prediction of computer cost (formulated) as the product of sample variance and time per particle history, sigma (2)/sub s/tau p) associated with a given set of splitting parameters. Optimum splitting surface locations and splitting ratios are determined. Benefits of such an analysis are particularly noteworthy for transport problems in which splitting is apt to be extensively employed (e.g., deep penetration calculations). DOE

N81-18833# Pennsylvania State Univ., University Park.
EXCITATION AND IONIZATION OF HIGHLY CHARGED IONS BY ELECTRON IMPACT Progress Report, 1 Aug. 1979 - 31 Aug. 1980
D. H. Sampson Sep. 1980 22 p refs
(Contract DE-AS02-76ET-53056)
(DOE/ET-53056/4) Avail: NTIS HC A02/MF A01

The reduced cross sections Q/sub R sup H (nl,u) were calculated for ionization from the nl = 4s, 4p, 4d and 4f sublevels and the results fitted to simple functions of the impact electron energy u in threshold units. The total ionization cross section with inclusion of the excitation autoionization contribution was obtained for Be-like and Li-like ions. The results for the Li-like ions N(4+) and O(5+) are in generally good agreement with expected results. Collision strengths and radiative line strengths for the (DELTA)n = 0 transitions in He-like and Be-like ions were calculated for additional Z values. DOE

N81-18834# Los Alamos Scientific Lab., N. Mex.
RELATIVISTIC OFF-MASS-SHELL AND OFF-ENERGY-SHELL SCATTERING THEORIES: AN APPLICATION OF THE ROTATION AND LORENTZ GROUPS Ph.D. Thesis - Texas Univ.
D. R. Giebink (Maryland Univ., College Park) Oct. 1980 255 p refs
(Contract W-7405-eng-36)
(LA-8548-T) Avail: NTIS HC A12/MF A01

A relativistic, phenomenological scattering theory for particles with arbitrary spin is presented and the relation between off-mass-shell and off-energy-shell theories is discussed. The theory is formulated from the Hilbert space representation of particles with spin in relativistic quantum mechanics. This topic was received in a basis independent manner by appealing to the properties of the rotation and Lorentz groups and their representations. Spin is discussed and a set of basis state vectors for the single-particle Hilbert space was derived from this perspective. Two- and three-particle Hilbert space bases were then constructed and angular momentum is discussed. The Z-circumflex and helicity bases are presented as examples of the general procedure. These foundations allow the on-shell scattering amplitude to be defined. The space inversion and time reversal properties of this amplitude suggest that a new scattering function be defined such that a continuation of that function to negative energies can be considered. DOE

N81-18835 California Univ., Los Angeles.
SEMI-ELECTRONIC DECAY PROPERTIES OF CHARMED D MESONS FROM THE PSI (3770) Ph.D. Thesis
Walter Joseph Bacino 1980 125 p
Avail: Univ. Microfilms Order No. 8103984

Charm production with semi-electronic decay from electron-positron annihilation about EC.M. = 3.77 GeV was measured. The data were taken at the SPEAR colliding beam facility using the DELCO detector which was designed specifically for the detection of prompt electrons and positrons through the use of a large solid-angle (70 percent of 4 pi), atmospheric gas Cherenkov counter. Inclusive semi-electronic branching fractions of the electrically neutral and charged D mesons are constrained with a relation fixed by the ratio of electron-associated charm events to the charm event total. Dissert. Abstr.

N81-18836 Illinois Univ. at Urbana-Champaign, Urbana.
CALCULATIONS FOR CHARGE-TRANSFER IN COLLISIONS

OF TRIPLY-IONIZED NITROGEN AND DOUBLY-IONIZED SULPHUR WITH HYDROGEN ATOMS Ph.D. Thesis
Randy B. Christensen 1980 159 p
Avail: Univ. Microfilms Order No. 8026466

The theoretical approaches used in the calculation of charge transfer collisions are presented. The calculations for charge transfer are described for two astrophysically significant ions, N(3+) and S(2+), with hydrogen atoms. These calculations indicate that charge transfer with H is the dominant neutralization mechanism for N(3+) over a range of astrophysically interesting conditions. For S(2+), neutralization through charge transfer with H seems to be quite small relative to other neutralization mechanisms (e.g., radiative electron recombination). The results indicate that for certain ions, charge transfer is by far the dominant neutralization mechanism. Results also indicate that detailed calculations are required to determine whether charge transfer is an important neutralization mechanism for any particular ion.
Dissert. Abstr.

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-18837# Naval Research Lab., Washington, D. C. Ionospheric Effects Branch.
STORAGE-RING GENERATION OF HIGH-ENERGY NEUTRINO BEAMS Interim Report
Francis J. Kelly, A. W. Saenz, and H. Ueberall 31 Dec. 1980 16 p refs
(RR0120241)
(AD-A094144; NRL-8457) Avail: NTIS HC A02/MF A01 CSCL 20/8

The storage ring method of generating high energy neutrino beams provides a source of monoenergetic neutrinos, which can be used for transterrestrial neutrino oscillation studies and for neutral current neutrino experiments in the laboratory. In this report, we consider several possible storage ring configurations, and estimate their counting rates for scientific and communications applications. GRA

N81-18838# Naval Research Lab., Washington, D. C.
CRITICAL ELEMENTS OF HIGH GAIN LASER FUSION
Stephen E. Bodner 21 Jan. 1981 49 p refs
(AD-A094103; NRL-MR-4453) Avail: NTIS HC A03/MF A01 CSCL 18/1

Progress toward high gain laser fusion can be measured by a set of five critical elements. They are the laser-to-fuel coupling efficiency, the cold fuel isentrope, the implosion asymmetry, the ablation pressure, and the ignition concept. GRA

N81-18839# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
HEAVY ION INERTIAL FUSION
D. Keefe and A. M. Sessler Jul. 1980 12 p refs Presented at the 11th Intern. Conf. on High Energy Accelerators, Geneva, Switzerland, 7-11 Jul. 1980
(Contract W-7405-eng-48)
(LBL-11146; CONF-800740-24) Avail: NTIS HC A02/MF A01

Inertial fusion has not yet been as well explored as magnetic fusion but can offer certain advantages as an alternative source of electric energy for the future. Present experiments use high-power beams from lasers and light-ion diodes to compress the deuterium-tritium (D-T) pellets but these will probably be unsuitable for a power plant. A more promising method is to use intense heavy-ion beams from accelerator systems similar to those used for nuclear and high-energy physics. The very high beam power needed poses new design questions, from the ion source through the accelerating system, the beam transport system, to the final focus. These problems will require extensive study, both theoretically and experimentally, over the next several years before an optimum design for an inertial fusion driver can be arrived at. DOE

N81-18840# Los Alamos Scientific Lab., N. Mex.
RADIO-FREQUENCY QUADRUPOLE LINEAR ACCELERATOR
Thomas P. Wangler and Richard H. Stokes 1980 7 p refs Presented at the 6th Conf. on the Appl. of Accelerators in Res. and Ind., Denton, Tex., 3-5 Nov. 1980
(Contract W-7405-eng-36)
(LA-UR-80-3139; CONF-801111-13) Avail: NTIS HC A02/MF A01

The radio frequency quadrupole (RFQ) is a new linear accelerator concept in which RF electric fields are used to focus, bunch, and accelerate the beam. Because the RFQ can provide strong focusing at low velocities, it can capture a high current dc ion beam from a low voltage source and accelerate it to an energy of 1 MeV/nucleon within a distance of a few meters. A recent experimental test at the Los Alamos Scientific Laboratory (LASL) confirmed the expected performance of this structure and stimulated interest in a wide variety of applications. The general properties of the RFQ are reviewed and examples of applications of this new accelerator are presented. DOE

N81-18841# Oak Ridge National Lab., Tenn.
DEMONSTRATION OF DIRECT ENERGY RECOVERY OF FULL ENERGY IONS AT 40 keV ON A PLT/ISX BEAM SYSTEM
W. L. Stirling, G. C. Barber, W. K. Dagenhart, R. R. Feezell, W. L. Gardner, H. H. Haselton, J. Kim, M. Menon, N. S. Ponte, and C. C. Tsai 1980 28 p refs Presented at the 6th Conf. on Appl. of Accelerators in Res. and Ind., Denton, Tex., Nov. 1980
(Contract W-7405-eng-26)
(CONF-801111-24) Avail: NTIS HC A03/MF A01

The desire for multisecond beams in the 80 keV/nucleon energy range at 10 MW/module emphasized the need for technological advances in several areas. At such beam energies, as much as 75 percent of the initial beam energy is retained in the unneutralized ion components. As a result, two questions immediately come to mind: how can one dispose of this energy; or better still, how can one efficiently recover this energy. The conventional way of treating such a problem is to deflect the ions out of the neutral beam and onto water-cooled plates or beam dumps. This method worked satisfactorily for 40 keV/nucleon beams in excess of 1.5 MW and approx. 0.5 s. However, the power per unit area to be disposed of in the high power, multisecond beams mentioned above is beyond present day technology. A solution to this problem is proposed which not only removes the need for beam dumps but also returns from 50 to 80 percent of the energy contained in the full energy ion component directly and dynamically to the high voltage supply.
DOE

N81-18842# Los Alamos Scientific Lab., N. Mex.
SPACE-CHARGE LIMITS IN LINEAR ACCELERATORS
Thomas P. Wangler Dec. 1980 28 p refs
(Contract W-7405-eng-36)
(LA-8388) Avail: NTIS HC A03/MF A01

This report presents equations that allow an approximate evaluation of the limiting beam current for a large class of radio-frequency linear accelerators, which use quadrupole strong focusing. Included are the Alvarez, the Wideroe, and the radio-frequency quadrupole linacs. The limiting-current formulas are presented for both the longitudinal and the transverse degrees of freedom by assuming that the average space-charge force in the beam bunch arises from a uniformly distributed charge within an azimuthally symmetric three-dimensional ellipsoid. The Mathieu equation is obtained as an approximate, but general, form for the transverse equation of motion. The smooth-approximation method is used to obtain a solution and an expression for the transverse current limit. The form of the current-limit formulas for different linac constraints is discussed.
DOE

N81-18843# Colorado Univ. at Boulder. Dept. of Physics.
ELEMENTARY PARTICLES AND HIGH ENERGY PHENOMENA Progress Report, Jan. - Dec. 1980
W. T. Ford Jan. 1981 21 p refs

(Contract DE-AC02-76ER-02114)
(COO-2114-45) Avail: NTIS HC A02/MF A01

The Fermilab tagged photon spectrometer has now gone through one shake-down run and most elements of the detector are operational. Data were obtained on both Cerenkov counters and it shows that the Cerenkov counters are working adequately. Similar results were obtained for the recoil chamber, the drift chambers and the SLIC. Work still is going on for the outriggers and the hadrometer. The MAC central drift chamber is now operational and has good resolution. The rest of the detector is also up with the exception of the outer muon counters. Work in theory continues along the lines of various photoproduction processes and the study of grand unified gauge theories. DOE

N81-18844# Massachusetts Inst. of Tech., Cambridge. Center for Theoretical Physics.
FUTURE INVESTIGATIONS IN ELECTROMAGNETIC NUCLEAR PHYSICS
E. Hadjimichael 1980 17 p refs Presented at Symp. on Perspectives on Electro and Photonucl. Phys., Saclay, France, Oct. 1980
(Contract DE-AC02-76ER-03069)
(CONF-8010138-2) Avail: NTIS HC A02/MF A01

Some basic problems in nuclear physics that may receive positive response from electro- and photonuclear research are discussed. Future directions for this research are outlined, and some specific experimental proposals compiled by a study group under the sponsorship of the Bates (MIT) Users Group are described. DOE

N81-18845# Stanford Linear Accelerator Center, Calif.
NUMERICAL DESIGN OF ELECTRON GUNS AND SPACE CHARGE LIMITED TRANSPORT SYSTEMS
W. B. Herrmannsfeldt Oct. 1980 21 p refs Presented at the Conf. on Charged Particle Opt., Glessen, West Germany, 8-12 Sep. 1980
(Contract DE-AC03-76SF-00515)
(SLAC-PUB-2631; CONF-800952-3) Avail: NTIS HC A02/MF A01

Capabilities and limitations of computer programs used to design electron guns and similarly space-charge limited transport systems are described. Examples of computer generated plots from several different types of gun problems are included. DOE

74 OPTICS

Includes light phenomena.

N81-18846 Missouri Univ. -Rolla.
MATHEMATICAL MODELING PROCESS APPLIED TO REFLECTOR DESIGN Ph.D. Thesis
Judith Ann Hankins 1980 194 p
Avail: Univ. Microfilms Order No. 8102272

A commentary is presented on some of the factors to be considered when formulating a computational model for use with a nonlinear optimization procedure. These factors include the mathematical description of elements of the model, their numerical condition, computational effort required, compatibility with an optimization algorithm, incorporation of personal judgement of the designer in the initial phases, and suitable display of the results of the design process. In particular, the mathematical model of an optical system is considered. The mathematical spline is used to represent the optical surface and the importance of numerical stability, amount of arithmetic necessary, and compatibility with the optimization routine are discussed. To provide a starting value for the optimization procedure, an interactive computer graphics system is developed which combines classic ray tracing calculations, spline representations, and regression analysis. This graphics capability is useful in all phases of design to exhibit intermediate and final results. Dissert. Abstr.

N81-18847 Stanford Univ., Calif.
OPTICAL PROBING OF THE ATMOSPHERE USING NONCOHERENT SPATIAL FILTERS Ph.D. Thesis
Stephen Alan DeLateur 1980 142 p
Avail: Univ. Microfilms Order No. 8103501

When an optical wave travels through clear air turbulence, inhomogeneities in the index of refraction cause intensity variations at a receiving or imaging plane. These effects allow remote sensing of the Earth's atmosphere. Two measurements of interest are path profiles of turbulence strength and wind velocity. The lack of path selectivity and difficulties in signal processing (due to the nonstationarity of the atmosphere) have characterized methods which employ covariance calculations of the received field to estimate cross path wind velocities. With a single-scatter, phase-screen model for clear air, an analysis of line of sight propagation is presented using Fourier optics. Included is a discussion of the assumed nature of the turbulence spatial spectrum. Specifications are detailed for the transmitter and receiver apertures and the processing of the received signal which provide estimates of the turbulence strength and transverse wind speed at selected points along the path. Dissert. Abstr.

N81-18848 California Univ., San Diego.
THE CODED-PHASE OPTICAL PROCESSOR AND ITS HYBRID IMPLEMENTATION Ph.D. Thesis
James Robert Leger 1980 323 p
Avail: Univ. Microfilms Order No. 8103791

The coded phase optical processor can perform any two dimensional linear transform, as well as pattern recognition and classification tasks not suited to correlation techniques. A two dimensional phase code is used to eliminate all but the central value of the correlation function produced by a coherent optical correlator. By superimposing shifted products of the phase code and a set of pattern functions in a computer generated spatial filter, the output consists of a set of points whose amplitudes correspond to the inner products between an input function and the set of pattern functions contained in the filter. The design of a computer controlled laser scanning system for making computer holograms is described. The system is capable of producing high quality holograms and spatial filters automatically with any impulse response. Sources of noise in computer holography are reviewed and methods to eliminate this noise are described. This system is then used to make the spatial filters for the coded-phase optical processor. Dissert. Abstr.

N81-18849 Rochester Univ., N. Y.
RADIOMETRY WITH PARTIALLY COHERENT LIGHT Ph.D. Thesis
Ari Tapio Friberg 1980 271 p refs
Avail: Univ. Microfilms Order No. 8104307

The problem of formulating a radiometric description of energy transfer in fluctuating optical fields were examined. Special emphasis is placed on examining, within the framework of the stochastic scalar wave theory, radiation produced by planar sources. It was demonstrated that no direct correspondence exists between all the quantities that describe energy transport in conventional radiometry and in the wave theory of light. In particular, it was shown that a radiance function cannot be associated with planar sources of every state of coherence in such a way that it would not be a violation of at least one of the postulates of conventional radiometry. However, a radiance function can be defined, as an appropriate linear transform of a function characterizing the second order coherence properties of the source, which leads to correct values for the radiant intensity produced by the source. A radiometric theory, applicable to planar sources of any state of coherence, was developed and is implications are illustrated by applying it to sources of several special types. Dissert. Abstr.

N81-18850 Rhode Island Univ., Kingston.
MULTISENSOR SURVEILLANCE DATA AUGMENTATION AND PREDICTION WITH OPTICAL MULTIPATH SIGNAL PROCESSING Ph.D. Thesis
Garret Thayer Bush, III 1980 343 p
Avail: Univ. Microfilms Order No. 8102310

The spatial characteristics of an oil spill on the high seas are examined in the interest of determining whether linear-shift-invariant data processing implemented on an optical computer would be a useful tool in analyzing spill behavior. Simulations were performed on a digital computer using data obtained from a 25,000 gallon spill of soy bean oil in the open ocean. Marked changes occurred in the observed spatial frequencies when the oil spill was encountered. An optical detector may readily be

developed to sound an alarm automatically when this happens. The average extent of oil spread between sequential observations was quantified by a simulation of non-holographic optical computation. Because a zero crossover was available in this computation, it may be possible to construct a system to measure automatically the amount of spread. Oil images were subjected to deconvolutional filtering to reveal the force field which acted upon the oil to cause spreading. Some features of spill-size prediction were observed. Calculations based on two sequential photos produced an image which exhibited characteristics of the third photo in that sequence. Dissert. Abstr.

N81-18851*# California Univ., Berkeley. Space Sciences Lab.
INSTRUMENTATION DEVELOPMENT FOR THE EUVE Progress Report, 15 Feb. - 15 May 1980
David Finley 2 Jun. 1980 34 p refs
(Contract NAS5-24445)
(NASA-CR-166631; SSL-Ser-21-Issue-7; Rept-9) Avail: NTIS HC A03/MF A01 CSCL 20F

The prototype mirror was successfully replated with a thick layer of nickel and diamond turned again. Optimization of the sesnitivity of the instruments was studied with emphasis on the filter material, and on the available telemetry. The JHU Preliminary Project Definition Document was critically analyzed. Further studies of the electron cloud distribution produced by a channel plate were performed, and a wedge and strip anode with 17 quartets per inch was shown to image with better than 0.5% linearity. Half the microchannel plates being used in the lifetest completed initial processing and are in the lifetest vacuum chamber. A.R.H.

N81-18852*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE PYROELECTRIC PROPERTIES OF TGS FOR APPLICATION IN INFRARED DETECTION
R. L. Kroes and D. Reiss Jan. 1981 35 p refs
(NASA-TM-82394) Avail: NTIS HC A03/MF A01 CSCL 20F

The pyroelectric property of triglycine sulfate and its application in the detection of infrared radiation are described. The detectivities of pyroelectric detectors and other types of infrared detectors are compared. The thermal response of a pyroelectric detector element and the resulting electrical response are derived in terms of the material parameters. The noise sources which limit the sensitivity of pyroelectric detectors are described, and the noise equivalent power for each noise source is given as a function of frequency and detector area. Author

N81-18853# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
POTENTIAL OF OPTICAL FOURIER ANALYSIS FOR MEASURING WINDSCREEN DISTORTION
Herschel C. Self Dec. 1980 34 p refs
(AF Proj. 7184)
(AD-A094127; AFAMRL-TR-80-104) Avail: NTIS HC A03/MF A01 CSCL 20/6

The potential of an optical Fourier technique for measuring the optical distortion of aircraft windscreens was examined. It was hypothesized that the compactness of the harmonics of the optical Fourier transforms of vertical and horizontal square wave targets photographed through windscreens would correlate highly with distortion in photographs of a gridboard. Eleven transparent optical distortion panels were used to produce gridboard pictures and vertical and horizontal transform pictures. Gridboard pictures were subjectively ranked by 23 observers for amount of optical distortion. Transform pictures were ranked for compactness of the third harmonic. All three picture sets were also measured by subjective magnitude estimation. Rank correlation between gridboard photograph distortion ranks and compactness ranks for the vertical Fourier transform was .950. Overall rankings of gridboard distortion photographs and compactness rankings was .977. Such high statistically significant correlations show that distortion judgements from gridboard photographs is accurately predictable from judged compactness of the third harmonic. Thus, the Fourier method may be useful for measuring optical distortion. Development of objective methods to measure the compactness and to calibrate such measures against conventional measurements is warranted. This development would lead to a rapid, accurate and objective method for measuring the optical distortion of aircraft windscreens. GRA

N81-18854# Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Angewandte Physik.
OPTICAL EXCITATION OF MOS INTERFACE STATES Final Technical Report, Sep. 1979 - May 1980
M. Schulz and K. Blumenstock Oct. 1980 51 p refs
(Grant DAJA37-79-C-0547; DA Proj. 1T1-61102-BH-57)
(AD-A094080) Avail: NTIS HC A04/MF A01 CSCL 09/5

MOS interface states have been studied in n-type samples by infrared optical excitation. Infrared light in the wavelength range 5 to 15 micrometers was used to excite only shallow states near the conduction band edge. Thermal background radiation was excluded in the irradiation by using cold interference filters for the spectral selection. For a sample with low density of states approx. 10 to the 10th power/sq cm ev, a consistent density was observed in the optical measurement with quasistatic measurements and CC-DLTS. The optical absorption cross-section sigma assumes low values which are in favor for a model which interprets interface states by tunneling into a discrete level in SiO2. Another sample with a high density of states shows a complicated behavior with a field dependence and inconsistency of the density of states observed by different techniques which cannot be completely interpreted. The absorption cross-section, however, also assumes low values below 10 to the -18th power sq cm. GRA

N81-18855# California Univ., Livermore. Lawrence Livermore Lab. Dept. of Physics and Astronomy.
GENERATION OF TUNABLE COHERENT FAR-INFRARED RADIATION USING ATOMIC RYDBERG STATES Ph.D. Thesis - Wyoming Univ.
William Bookless Dec. 1980 173 p refs
(Contract W-7405-eng-48)
(UCRL-53075) Avail: NTIS HC A08/MF A01

A source of tunable far-infrared radiation is described. The system was operated at 91.6/cm with a demonstrated tunability of .63/cm. The system is based on a Rydberg state transition in optically pumped potassium vapor. The transition energy is tuned by the application of an electric field to the excited vapor. The transition wavelength and the shifted wavelength were detected and measured by the use of a Michelson interferometer and a liquid helium cooled Ga:Ge bolometer, and the data was reduced using Fast Fourier transform techniques. Extensive spectroscopy was done on the potassium vapor to elucidate the depopulation paths and rates of the excited levels. Both theoretical and experimental results are presented to support the conclusions of the effort. Additionally, possible alternative approaches to the population of the excited state are explored and recommendations are made for the future development of this source as well as the potential uses of it in molecular spectroscopy. DOE

N81-18856# Human Engineering Labs., Aberdeen Proving Ground, Md.
A COMPUTER SIMULATION MODEL OF OUTDOOR RADIANT LIGHTING Final Report
Christopher C. Smyth Jul. 1980 46 p refs
(AD-A094427; HEL-TN-10-80) Avail: NTIS HC A03/MF A01 CSCL 17/8

A deterministic computer model of outdoor daytime (nighttime) radiant lighting is described for a clear sky and slight ground-level haze. Equations are developed for the radiance at an observer's position, which is emitted from a target and the surrounding background. The equations are a function of the positions of the Sun (Moon), the target and the observer. The equations include the effects of atmospheric attenuation, the background sky light, and the ground cover. The computer model was developed for use in simulation studies of target visibility. GRA

N81-18857 Arizona Univ., Tucson.
INFRARED SPECKLE INTERFEROMETRY Ph.D. Thesis
Robert Richard Howell 1980 130 p
Avail: Univ. Microfilms Order No. 8104292

The development of an infrared speckle interferometer is described. This instrument uses a modified version of the technique

pioneered by Sibille, Chelli, and Lena. The secondary mirror is used to scan the image across a narrow slit. Each scan is Fourier transformed and the modulii squared of many such transforms are coadded. Both the object of interest and a point source are observed. The square root of the ratio of their power spectra is the visibility as defined by Michelson. This system was assembled for the most part with existing equipment and the design should be readily adaptable to other observatories. Initial tests were made with the 154 cm telescope of the University of Arizona since it had a preexisting mechanism for scanning the secondary. However most of the observations were carried out with the University's 229 cm telescope. A new linear servo was added to the existing hard-stop chopper for this telescope's f/45 secondary. Dissert. Abstr.

N81-18858 Rochester Univ., N. Y.
ULTRAFAST OPTICAL PULSE SHAPING Ph.D. Thesis
John Alphonse Agostinelli 1980 208 p
Avail: Univ. Microfilms Order No. 8104301

A passive pulse shaping system and two active pulse shaping systems are constructed and tested experimentally. Each system is analyzed and the analytical and experimental results are compared. For the active systems, the ultimate risetimes are calculated for the particular active devices which are utilized. A fairly comprehensive review of the entire field of ultrafast pulse shaping is undertaken. The passive system incorporates a pair of diffraction gratings and various filtering operations. It produces pulses of arbitrary temporal intensity profile from short (mode locked Nd:YAG) input pulses. The shape resolution in the output pulse is of the order of the input pulsewidth. The shaped output pulse is shown to be linearly frequency modulated. With the largest gratings available commercially, total pulse lengths of about 2 ns appear to be possible. The active pulse shaping systems include linear electro-optic (Pockels cell) and nonlinear electro-optic (Kerr cell) modulators, each driven by light activated semiconductor switch circuitry. Dissert. Abstr.

N81-18859 Tennessee Univ., Knoxville.
OPPOSITION EFFECT EXPERIMENTATION AND A THEORETICAL INVESTIGATION INVOLVING CYLINDERS Ph.D. Thesis
Willard Wayne Montgomery 1980 148 p
Avail: Univ. Microfilms Order No. 8104610

The existence, shape, and polarization characteristics of the backscattered peak due to the opposition effect were investigated using an optical system of greater resolution than previously reported used. The samples studied, many previously unexamined, include some organic materials. Even with improved system resolution, opposition effect peaks produced by some samples are not fully resolved. Three theoretical problems are investigated. Two of these address the scattering of plane electromagnetic waves by single infinite circular cylinders. In the first, the cylinder is embedded in a homogeneous half space. In the second, the cylinder is adjacent to a homogeneous half space. The third addresses the scattering produced by three identical, noncoplanar, dielectric cylinders. A back scattered peak, comparable to that of the opposition effect, is obtained for cylinders with diameters comparable to the wavelength of the incident radiation.
Dissert. Abstr.

N81-18989*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A BINARY COHERENT OPTICAL RECEIVER FOR THE FREE-SPACE CHANNEL
V. A. Vilnrotter *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 27-38 refs (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-18860 Carnegie-Mellon Univ., Pittsburgh, Pa.
APPLICATION OF MONTE CARLO METHODS TO THE STUDY OF TRANSPORT AND SLOWING DOWN OF FAST CHARGED PARTICLES IN FUSION PLASMAS, VOLUMES 1 AND 2 Ph.D. Thesis
Donald Edward Dei 1980 341 p
Avail: Univ. Microfilms Order No. 8100608

The application of Monte Carlo methods to the study of energetic ions in thermonuclear plasmas is investigated. In particular, an analog Monte Carlo model for the combined treatment of the spatial transport and slowing down process of fast charged particles in multicomponent Maxwellian plasmas is developed for both infinite media and toroidal devices. The successful development and application of this model to realistic fusion reactor problems demonstrates the overall feasibility of the method and illustrates its practicality and capability. The treatment of Coulomb elastic scattering with the background plasma forms the foundation of the Monte Carlo method. A catastrophic event model is employed whereby each particle history is treated as a series of slowing down segments which are terminated by a (large angle scattering) catastrophic event and a continuous slowing down model is applied between events. A slowing down model based on binary collision theory provides the basis for the catastrophic event sampling techniques as well as the continuous slowing down treatment. A FORTRAN 4 computer program, written to implement the Monte Carlo method, is described and applied to two infinite medium problems and one Tokamak-type, neutral beam injection problem.
Dissert. Abstr.

N81-18861 Cornell Univ., Ithaca, N. Y.
FORMATION, PROPAGATION AND REFLECTION OF A ROTATING PROTON RING IN A MAGNETIC MIRROR Ph.D. Thesis
Philip Lewis Dreike 1980 375 p
Avail: Univ. Microfilms Order No. 8102935

The following basic issues of physics which underlie trapping a proton ring with strong self magnetic fields in a magnetic mirror was examined theoretically and experimentally: proton source current and emittance, change and current neutralization of an intense proton beam propagating across a magnetic field, dynamics of a rotating beam and beam formed plasma, including self-magnetic field effects and removal of axial energy from a propagating ring so it can be trapped in a mirror well. The results of pilot experiments with magnetically insulated ion diodes and rotating proton beam propagation are described first. The principal results on proton ring formation and propagation are from the scaled up Ion Ring Experiment. Dissert. Abstr.

N81-18862# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DYNAMICS OF TWO-DIMENSIONAL SOLITARY VORTICES IN A LOW-BETA PLASMA WITH CONVECTIVE MOTION
Mitsuhiro Makino, Tetsuo Karimura, and Tosiya Taniuti Dec. 1980 32 p refs
(IPPJ-496) Avail: NTIS HC A03/MF A01

Numerical studies of the Hasegawa-Mima equation, derived in the content of drift waves but equivalent to the quasi-geostrophic vortex potential equation for Rossby waves, show the stable properties of solitary vortices which are two dimensional, localized, steady and translating solutions of this same equation. A solitary vortex can propagate only in the direction (x-direction) perpendicular to the density gradient. When this solitary vortex solution is inclined at some angle with respect to the x-axis, its propagation direction oscillates in the x and y plane. In two dimensional collisions, i.e. head-on collision and overtaking, solitary vortices interact two dimensionally and recover their initial shapes at the end of both types of collisions. Author

N81-18863# California Univ., Los Angeles. Center for Plasma Physics and Fusion Engineering.
GENERATION AND COLLAPSE OF LANGMUIR SOLITONS IN A NONUNIFORM PLASMA
N. R. Pereira and G. J. Morales Nov. 1980 29 p refs
(Contract N00014-75-C-0476)
(AD-A094305; PPG-529) Avail: NTIS HC A02/MF A01 CSCL 20/9

This numerical study considers the effect of a zero order

density gradient on the development of Langmuir wave collapse in two dimensions. Two different situations are considered: (1) an initial soliton is perturbed in a direction transverse to the density gradient, and (2) the plasma is resonantly driven by an external pump electric field in the presence of transverse density fluctuations. The principal finding is that the density gradient can inhibit the development of Langmuir collapse for both the initial soliton and the externally driven cases. Over the limited parameter space surveyed it is found that collapse occurs for values of the scaled gradient parameter g < or about = 2.5; where g = (9.8)(M/m) to the 3/2 power (lambda sub D/L), M is the ion mass, m the electron mass, lambda sub D the Debye length, and L the gradient scale length. For larger values of g collapse is not observed. GRA

N81-18864# Science Applications, Inc., McLean, Va.
RADIATION FROM HIGH TEMPERATURE PLASMAS Final Report, 26 Jun. 1979 - 26 Aug. 1980
John Apruzese, Edward Kane, Peter Vitello, Dwight Duston, and Adam Drobot 9 Sep. 1980 157 p refs
(Contract N00173-79-C-0448)
(AD-A094186; SAI-81-239-W/A) Avail: NTIS HC A08/MF A01 CSCL 20/9

This report presents analyses of the detailed physical processes of importance in imploding wire and gas puff plasmas. Accurate treatment of the atomic physics and radiation transport underlying the X-ray exchange and output is emphasized. Feedback coupling of radiation and hydrodynamics are examined through use of coupled radiation hydrodynamics codes and analysis of motional Doppler broadening of line radiation. GRA

N81-18865# JAYCOR, Alexandria, Va.
ECRH STUDIES ON TOKAMAK PLASMAS Final Report, 17 Sep. 1979 - 30 Sep. 1980
Ronald Gilgenbach 10 Oct. 1980 52 p refs
(Contract N00173-79-C-0472)
(AD-A094043; JAYCOR-PSD-200-80-009FR) Avail: NTIS HC A04/MF A01 CSCL 18/1

A summary is provided of electron cyclotron heating (ECH) experiments on the ISX-B (Impurity Studies Experiment-B) Tokamak and the development of electron temperature diagnostics at second harmonic. GRA

N81-18866# Indiana Univ. at Bloomington. Dept. of Chemistry.
OPERATIONAL CHARACTERISTICS OF A HELIUM MICROWAVE-INDUCED PLASMA AT ATMOSPHERIC PRESSURE Interim Technical Report
Andrew T. Zander and Gary M. Hieftje 26 Jan. 1981 20 p refs Submitted for publication
(Contract N00014-76-C-0838)
(AD-A094343; TR-30) Avail: NTIS HC A02/MF A01 CSCL 20/9

The microwave-induced helium plasma generated at atmospheric pressure in the TM010 resonant cavity is attractive as an excitation source for emission spectrometry. The efficiency of the cavity produces an extremely high energy-density plasma and its short longitudinal dimension permits close spatial and photometric monitoring system proximity between the plasma and different types of sampling devices. Examination of the electron density, excitation temperature and rotational temperature in this microwave plasma reveals its unusual character and suggests certain mechanisms of operation. GRA

N81-18867# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
LASER DIAGNOSTICS OF METALLIC PLASMAS Final Report, 1 Nov. 1978 - 31 Oct. 1981
David R. Bach, Don Kania, and James J. Duderstadt Dec. 1980 32 p refs
(Grant AF-AFOSR-0030-79; AF Proj. 2301)
(AD-A094564; AFOSR-81-0010TR) Avail: NTIS HC A03/MF A01 CSCL 20/9

The major objectives of this research project were to study the X-ray emission and dynamical behavior of exploded aluminum wire plasmas when subjected to intense CO2 laser radiation. The laser system based on Lumonics 601 TEA laser was optimized to produce a diffraction limited spot size (diameter 125 microns) yielding a focused intensity of 10 to the 12th power w/sqcm. The principal X-ray diagnostics consisted of two foil measurements using filtered photomultiplier detectors. These measurements were augmented by a variety of electrical and optical diagnostics to determine the time evolution of the exploding wire and the effects of the laser irradiation. Interaction experiments were performed with a radial, one sided illumination at the plasma midplane. The data obtained in these experiments is discussed and analyzed in the report. GRA

N81-18868# Department of Energy, Washington, D. C. Office of Energy Research.
STATUS OF COMPACT-TOROID RESEARCH USING HIGH ENERGY PARTICLE BEAMS
Oct. 1980 21 p
(DOE/ER-0088) Avail: NTIS HC A02/MF A01

A workshop on the use of high-energy particle beams to generate compact-toroid plasma geometries was held to help formulate program plans for this work, and assessing its importance relative to the rest of the compact toroid (CT) program. The scope of the workshop and the charge to the panel of advisors responsible for writing this report are presented. DOE

N81-18869# Wisconsin Univ. - Madison. Dept. of Physics.
HIGH POWER HEATING IN THE ION CYCLOTRON RANGE OF FREQUENCIES IN THE WISCONSIN TOKAPOLE 2
A. P. Biddle and J. C. Sprott Sep. 1980 33 p refs
(Contract DE-AC02-76ET-33051)
(DOE/ET-53051/11) Avail: NTIS HC A03/MF A01

Fast wave heating at the second, third, and fourth harmonics of the ion cyclotron resonance, and slow wave heating at the fundamental in a single ion species hydrogen plasma, are found to be in good agreement with warm plasma theory at RF power levels less than or equal to 130 kW. on heating is negligible off an eigenmode. Ion body temperatures are more than doubled to 75 eV from the 35 eV ohmically heated case with tails comprising 8% of the plasma at 320 eV. No deleterious effects except a nondisruptive 10% shortening of the discharge length caused by impurity influx are noted. A passive mode tracking technique allows approximately 50% increase in power deposition in a passing eigenmode over that of a fixed frequency RF source. Ion temperatures are limited by charge exchange due to the < 50 eV central temperature and the small 13 cm radius current channel. DOE

N81-18870# Johns Hopkins Univ., Baltimore, Md.
EXTREME ULTRAVIOLET AND SOFT X-RAY DIAGNOSTICS OF HIGH-TEMPERATURE PLASMAS Annual Progress Report
H. Warren Moos and L. Armstrong, Jr. 1980 81 p refs
(Contract DE-AS02-76ET-530006)
(DOE/ET-53006/6) Avail: NTIS HC A05/MF A01

Extreme ultraviolet diagnostic studies have been performed at the Alcator A and C Tokamaks, and on TMX. A toroidal asymmetry was found in the low density phase of Alcator A. The confinement time of impurities was measured on Alcator A. Impurity concentrations in the center cell of TMX were studied using EUV spectroscopic techniques. DOE

N81-18871# Sandia Labs., Albuquerque, N. Mex.
STATUS OF ADVANCED BREMSSTRAHLUNG CONVERTERS
J. A. Halbleib 1980 38 p refs Presented at the 6th JOWOG Conf., Albuquerque, N.Mex., 7 Oct. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-2536C; CONF-8010128-4) Avail: NTIS HC A03/MF A01

The development of bremsstrahlung converters as part of the particle beam approach to inertial confinement fusion is reviewed. Five converter concepts are briefly described and features critical to their development are listed. DOE

N81-18872# Sandia Labs., Albuquerque, N. Mex.
PHENOMENOLOGICAL STUDIES OF ELECTRON-BEAM TRANSPORT IN WIRE-PLASMA CHANNELS
G. J. Lockwood and W. Beezhold 1980 14 p refs Presented at the 6th JOWOG Conf., Albuquerque, N.Mex., 7 Oct. 1980
(Contract DE-AC04-76DP-00789)

(SAND-80-2496C; CONF-8010128-2) Avail: NTIS HC A02/MF A01

The formation mechanisms of wire-initiated plasma channels in air were examined and the subsequent transport efficiencies of relativistic electron beams through various-length straight and curved plasma channels were determined. Electron transport efficiency through a channel was measured to be 80 to 100% of a zero length channel for 40 cm long straight channels and for curved channels which redirected the electron beam through an angle of 90 deg. Studies of simultaneous e-beam transport along two curved channels closely spaced at the converter showed that transport efficiency remained at 80 to 100%. However, it was observed that the two e-beams were displaced towards each other. Transport efficiency depended only weakly on parameters such as wire material, wire length and shape, diode anode aperture, e-beam injection time, and wire-channel applied voltage. For off-center injection conditions, the electron beam strongly perturbed the plasma channel in periodic or regularly spaced patterns even though the total energy lost by the electron beam remained small. Plasma-channel transport, when all experimental parameters are optimized for maximum transport efficiency, is a workable method for directing electron beams to a converter target. DOE

N81-18873# New York Univ., N. Y. Inst. of Mathematical Sciences.

HALL CURRENT EFFECTS ON TEARING MODES IN ROTATING REVERSE FIELD PLASMAS

Jay Kappraff (New Jersey Inst. of Technology), William Grossman, and Michael Kress Mar. 1980 63 p refs

(Contract DE-AC02-76ER-03077; Grant AF-AFOSR-2881-76)

(DOE/ER-03077/165) Avail: NTIS HC A04/MF A01

It was experimentally observed that certain tearing modes in plasmas may be suppressed if the plasma rotates in a preferred direction. The m=0, finite wavelength tearing mode in cylindrical geometry for a reversed field plasma equilibrium was examined and it was shown that by generalizing Ohm's law to include Hall current terms, it is possible to explain this effect of rotation on tearing modes. Results agree qualitatively with earlier analysis and numerical simulations. Results are sensitive to the position of the other conducting wall, and for wall positions sufficiently close to the plasma vacuum interface, tearing modes may be quenched when the rotation reaches a critical value. These results follow from a boundary layer analysis and numerical integration of the boundary layer equations. DOE

N81-18874# Princeton Univ., N. J. Plasma Physics Lab.

STABILITY OF COLLIDING ION BEANS

E. A. Foote and R. M. Kulsrud Nov. 1980 39 p refs

(Contract DE-AC02-76CH-03073)

(PPPL-1724) Avail: NTIS HC A03/MF A01

Conditions are determined for stability of two identical colliding ion beams in the presence of neutralizing electrons, but no background ions. Such a situation is envisioned for the Counter-streaming Ion Torus. The ion beams are taken to be Maxwellian in their frames of reference. The approximation of electrostatic and electromagnetic modes is made. The stability of the electrostatic modes depends on the relation between the ion electron temperature ratio and the relative beam velocities. The Stability of the electromagnetic mode depends on the relation between the ion plasma (BETA) and the relative beam velocities. DOE

N81-18875# Wisconsin Univ. - Madison.

PLASMA RESISTIVITY MEASUREMENTS IN THE WISCONSIN LEVITATED OCTUPOLE Ph.D. Thesis

David Allen Brouchous Nov. 1980 209 p refs

(Contract DE-AS02-76ET-53051)

(DOE/ET-53051/13) Avail: NTIS HC A10/MF A01

Resistivity measurements parallel to the magnetic field were made on gun injected plasmas ranging in density from 10 to the 9th/cu cm to 10 to the 12th/cu cm in the Wisconsin levitated octupole with toroidal and poloidal magnetic fields. The 10 to the 9th/cu cm plasma was collisionless with lambda sub mfp > 100 mirror lengths, had T sub e = 10 eV, T sub i/ = 30 eV and was found to have anomalous resistivity scaling like eta = (RADICAL) T/sub e/n/sub e when E is more than E/sub c is the Dreicer critical field. The 10 to the 12th/cu cm plasma was collisional with lambda/sub mfp/ < mirror length, had T/sub e = T sub i approx. = .2 eV and was found to have Spitzer resistivity when < E sub c. DOE

N81-18876# Montreal Univ. (Quebec). Dept. de Physique.

RADIAL DISTRIBUTION OF THE ELECTRON DENSITY AND OF THE DENSITY OF EXCITED ATOMS IN A PLASMA COLUMN PRODUCED BY A SURFACE WAVE [DISTRIBUTION RADIALE DE LA DENSITE ELECTRONIQUE ET DE LA DENSITE DES ATOMES EXCITES DANS UNE COLONNE DE PLASMA PRODUITE PAR UNE ONDE DE SURFACE]

M. Moisan, R. Pantel, A. Ricard (Paris XI Univ., Orsay, France), V. M. M. Glaude, P. Leprince (Paris XI Univ., Orsay, France), and W. P. Allis (MIT, Cambridge) Jul. 1979 100 p refs

Avail: NTIS HC A05/MF A01

The radial distribution of excited atoms in an argon plasma produced by a surface wave was observed. The measurements were made recording emission absorption at a given wavelength as a function of the radius. Depending on the neutral gas pressure (between 50 and 350 m Torr), on the electron density and on the plasma diameter, the radial distribution is either flat or has a minimum on the axis and a maximum near the tube wall. This behavior is explained theoretically by showing that the population density of radiative levels is proportional to n(r) E squared (r) is the electric field intensity of the surface wave. Author (ESA)

N81-18877 Stanford Univ., Calif.

FLUCTUATIONS IN COMBUSTION-DRIVEN MHD GENERATORS Ph.D. Thesis

John Paul Barton 1980 414 p

Avail: Univ. Microfilms Order No. 8103483

The results of an experimental and theoretical investigation of the inherent fluctuations that occur within combustion driven magnetohydrodynamic generators are presented. The primary concern was to determine the presence and effects of axially propagating linear hydrodynamic traveling waves of the magnetoacoustic and magnetoentropic types. The possible development of large fluctuations in high magnetic interaction MHD generators caused by hydrodynamic traveling waves propagating with increasing amplitude was considered. Experimentally time resolved measurements of pressures, electrode currents, and internal differential voltages within a laboratory scale, combustion driven MHD generator facility were analyzed to determine the nature of the inherent fluctuations. A special probe tube microphone provided a sensitive measurement of the pressure fluctuations within a combustion driven MHD generator duct. Dissert. Abstr.

N81-18878 California Univ., San Diego.

AN EXPERIMENT TO MEASURE LOW FREQUENCY PLASMA FLUCTUATIONS BY LARGE APERTURE HOMODYNE METHODS Ph.D. Thesis

Thomas Robert Angles 1980 148 p

Avail: Univ. Microfilms Order No. 8103776

In order to measure the low frequency drift waves, propagating nearly perpendicular to the toroidal magnetic field in Tokamak plasmas, a forward scattering system was constructed and assembled on the UCLA Microtor. A nonflow low pressure 10 kilowatt half millisecond pulse carbon dioxide laser was designed and constructed for this experiment. Using only mirrors to profile the laser output beam, a large aperture portion was passed (up and down) through the minor cross section of the plasma. This apparatus was designed to measure plasma wavelengths in the range of 1 to 10 mm and wave frequencies between 4 KHz and 4 MHz. The scatter angle was indicative of the wavelength using the Bragg condition. Homodyne detection of the natural diffracted background radiation mixed with the scattered radiation gave the plasma wave frequency. Detector signal strength was indicative of the absolute plasma wave amplitude. Dissert. Abstr.

N81-18879 Rensselaer Polytechnic Inst., Troy, N. Y.

A HEAVY ION BEAM PROBE STUDY OF THE TOKAMAK SPACE POTENTIAL IN RENTOR Ph.D. Thesis

Catherine Louise Fiore 1980 264 p

Avail: Univ. Microfilms Order No. 8103757

A heavy ion beam probe diagnostic system was used to

demonstrate the capability of measuring the plasma space potential in a Tokamak. A 15-25 keV Rb(+) ion beam was used to study the search Tokamak facility, RENTOR (R = 45 cm,r = 15 cm). The heavy ion beam probe measurements showed that the central core of the plasma was approx. 5 cm in radius, centered 8 cm inside of the magnetic axis. The initial plasma formation was 4 cm below the midplane of the vacuum chamber, and slowly rose with the decay of the toroidal point to a point 4 cm above the midplane. The central core plasma also moved 2 cm radially outward just before the pulse ended and the plasma current channel collapsed. Peak densities in RENTOR were 5 x 10 to the 12th power cu/cm (4 mm microwaves) and the estimated electron temperature (from the heavy ion beam probe data) was approx. 30 eV. The space potential is formed at a large, positive level (approx 300 volts) and decreased with time throughout the current pulse for most of the plasmas observed. Large spikes in the potential were found (approx 200 V) coincident with changes in the loop voltage. These may be attributable to runaway electron effects. Dissert. Abstr.

N81-18880 Rensselaer Polytechnic Inst., Troy, N. Y.
STUDY OF PLASMA CONFINEMENT IN ELMO BUMPY TORUS WITH A HEAVY ION BEAM PROBE Ph.D. Thesis
Francis Michael Bieniosek 1980 132 p
Avail: Univ. Microfilms Order No. 8103751

Spatially resolved measurements of the resulting electric space potential were made in a single plasma cross section by the heavy ion beam probe. This diagnostic injects a 4-60 keV beam of (usually) Cs(4) ions into the plasma. Measurement of the energy of Cs(2)(+) secondary ions leaving the plasma gives a continuous monitor of the local space potential. In addition, the total detected Cs(2)(+) ion current is proportional to the product of the local electron density and the ionization rate, which in turn is a function of the electron temperature. This signal, nf (T sub e), is sensitive to all 3 electron distributions found in EBT, those of the cold surface plasma, warm core plasma, and hot electron ring. Dissert. Abstr.

76 SOLID-STATE PHYSICS

Includes superconductivity.
For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

N81-18881 Connecticut Univ., Storrs.
PHONON SCATTERING BY POINT DEFECT IMPURITIES IN COPPER ALLOYS AT VERY LOW TEMPERATURES Ph.D. Thesis
Sadanand Nanjundiah 1980 120 p
Avail: Univ. Microfilms Order No. 8103212

Experimental investigations were made of the low temperature lattice thermal conductivity of copper tin alloys. Solute contents of tin ranged from 0.5 a/o to 3.0 a/o. The lattice thermal conductivity was extracted from the measured total thermal conductivity in the temperature range 1.5 K to 55 K. Samples of these alloys were measured in states of heavy deformation and high temperature anneal. The determination of the lattice thermal conductivity provided a means by which various phonon scattering mechanisms present in the sample could be investigated. Lattice thermal conductivity results were analyzed by means of the standard scattering integral. Phonon relaxation times corresponding t scattering by electrons, dislocations point defects and Umklapp processes, were included in the analysis. In the analysis of the scattering of phonons by point defects, both mass difference between solute and solvent atoms and the distortion of the lattice around the point defect were necessary to account for the experimentally obtained parameter. Phonon scattering by tin in copper was observed to be stronger than nickel, aluminum or germanium in copper. Dissert. Abstr.

N81-18882 Cornell Univ., Ithaca, N. Y.
CHEMISORPTION OF CARBON MONOXIDE AND AMMONIA ON NICKEL AND IRIDIUM SURFACES Ph.D. Thesis
Charles Ward Seabury 1980 200 p
Avail: Univ. Microfilms Order No. 8102936

The process of chemisorption of small molecules on transition metal surfaces was investigated from the point of view of two prototype adsorption systems, carbon monoxide on iridium [100] and [111] and ammonia on nickel [111]. Microscopic details such as the nature of interactions between adsorbed species were addressed experimentally. Angle resolved ultraviolet photoelectron spectroscopy (UPS) with synchrotron radiation was used as the primary surface analytical probe. Because of the large number of variable parameters several systematic forms of measurement and analysis were employed. Dipole selection rules allow the use of variable polarization to determine orbital symmetry and molecular orientation. Variations in the photoemission intensity as a function of emission angle and photon energy were compared in detail with model calculations. The qualitative nature of the agreement is discussed in an effort to assess the utility of this approach for determining overlayer structure. The conservation of electron momentum parallel to the surface allows one to observe directly the formation of two dimensional dispersive band structure in dense overlayers. Dissert. Abstr.

N81-18883 Cornell Univ., Ithaca, N. Y.
MONTE CARLO STUDY OF PHASE TRANSITIONS IN TWO DIMENSIONAL SYSTEMS WITH CONTINUOUS SYMMETRY Ph.D. Thesis
Jan Tobochnik 1980 125 p refs
Avail: Univ. Microfilms Order No. 8102933

Several two dimensional systems with continuous symmetry are explored using Monte Carlo computer simulater. The systems studied include the planar spin model, a novel hard spin model, the Lennard-Jones systems at three densities, and the hard disk model. In the planar model, results show that the behavior of the susceptibility, spin-spin correlation function and the vortices were found to be consistent with the Kosterlitz-Thouless theory of vortex unbinding at the phase transition. The potential for the hard spin model is defined to be infinite if the cosine of the angular difference between a spin and any of its nearest neighbors is less than a specified parameter beta. Otherwise the potential is zero. The susceptibility for this model diverges at beta approx. = -0.30 and there is a sharp change in the slope of the nearest neighbor correlation versus beta curve near beta = -0.45. Vortices also appear at beta = -0.45. Numerical agreement between the values obtained for the elastic constant in the Lennard-Jones system and the Kosterlitz-Thouless-Halperin-Nelson-Young theory of melting. Dissert. Abstr.

N81-18884 State Univ. of New York at Buffalo, Amherst.
AN EXPERIMENTAL STUDY OF PRETRANSITIONAL EFFECTS OF LIQUID CRYSTAL PHASE TRANSITIONS Ph.D. Thesis
Khoon Cheng Lim 1980 123 p
Avail: Univ. Microfilms Order No. 8104213

Due to the strong coupling between the orientational order and smectic orders, high resolution birefrigence measurement was used to study the nematic to smectic A, smectic A to smectic C, and smectic A to smectic B phase transitions. A second order nematic to smectic A transitions was observed. An unusual suppression of the birefrigence was discovered near transition, yielding a specific heat critical exponent which is neither mean field nor helium like. The smectic B is thought to be two dimensional solid like. The B-A transition was sharply first order and pretransitional effects were observed. The critical divergence of the cholesteric pitch near to cholesteric to smectic C transition was measured. Because it is a strongly first order transition, the comparison between the data and theoretical predictions is not conclusive. Dissert. Abstr.

N81-18885 Washington Univ., St. Louis, Mo.
IMPURITY GRADIENTS DUE TO SURFACE STATES AND SUBSTRATE DOPING IN EPITAXIAL GaAs Ph.D. Thesis
Kirby Bratkowski Hugh Nichols 1980 132 p
Avail: Univ. Microfilms Order No. 8103715

An impurity gradient model is presented which shows that such effects are inherent to the growth process. When the carrier concentrations in the substrate, growing layer, and at the growth surface are different at the growth temperature, nonuniform time dependent electric fields are obtained in the layer. These fields can enhance or retard the motion of ionized impurities and defects during growth, producing impurity gradients at the outer surface

and different conductivity regions at the epitaxy substrate interface. *High temperature resistivity and Hall coefficient measurements* were made on epitaxial layers and substrates and analyzed using a self consistent four band model to obtain quantitative results for the impurity gradient model. Using these data, a time independent impurity gradient model for growth on heavily doped n type substrates predicts that thin p type regions at the epitaxy substrate interface will be produced under conditions encountered in the epitaxial growth of GaAs. Zero bias capacitance measurements on Schottky barrier diodes reveal the presence of heavily doped n type regions near the outer surface for layers grown on heavily doped n type substrates. Dissert. Abstr.

N81-18886 North Carolina Univ. at Chapel Hill.

RESOLVENT METHOD APPLIED TO ELECTRONIC SURFACE AND RESONANCE STATES IN SEMICONDUCTORS Ph.D. Thesis

Travis Leonard Spratlin 1980 136 p
Avail: Univ. Microfilms Order No. 8104425

The exact solution for the solvent matrix of a generalized tridiagonal Hamiltonian whose elements are themselves block matrices is obtained. The capability of the method is demonstrated by applying it to the study of the electronic structure on the surface of semiconductors. The resolvent method is applied to the silicon (111) 1 x 1 surface. Using the tight binding method the electronic surface states of the silicon are studied as a function of the relaxation of the first atomic layer. The local density of states is calculated for the first eight atomic layers. In addition, the surface and resonance states are examined. Dissert. Abstr.

N81-18887 Stevens Inst. of Tech., Hoboken, N. J.

THE VAN DER WAALS INTERACTION BETWEEN ATOMS AND SURFACES IN A QUANTIZING MAGNETIC FIELD Ph.D. Thesis

Steven Jack Silverman 1980 317 p
Avail: Univ. Microfilms Order No. 8100858

The Van Der Waals (V.D.W.) interaction energy between a neutral atom and a semiconductor/metal surface plasma in a normal magnetic field was analyzed using thermodynamic Green's function techniques. The formulation of the perturbation theoretic calculation of V.D.W. energy to second order in the Coulomb interaction (non retarded limit) treats dipole terms in detail, with some discussion of quadrupole terms. The interaction energy is cast and interpreted in terms of an effective potential function involving dynamic nonlocal plasma imaging. Treatment of the dynamic plasma image associated with mobile carriers of the bounded semiconductor/metal in a magnetic field incorporates nonlocal plasma properties using the infinite barrier random phase approximation (R.P.A.) description of plasma dynamics.
Dissert. Abstr.

N81-18888 Stevens Inst. of Tech., Hoboken, N. J.

EXPERIMENTAL INVESTIGATION OF NONLINEAR CONDUCTIVITY OF SUPERCONDUCTING ALUMINUM FILMS Ph.D. Thesis

Bruce Anthony Tirri 1980 164 p
Avail: Univ. Microfilms Order No. 8100859

Measurement on the flux-flow properties of thin cylindrical aluminum films were performed up to voltages large enough to exceed the voltage V where nonlinear flux flow dominates. A negative dynamic resistance was found by stabilizing the current-voltage characteristics with a normal conducting gold film on the inside of the substrate in parallel with the aluminum film which is on the outside. At low voltages the current increases linearly with electric field, indicating the presence of flux-flow and a constant flux-flow resistance. The cylindrical construction insures the absence of edge effects and low pinning. As the voltage is increased further, the current through the aluminum film approaches a maximum. Below 0.93 critical T and for low magnetic fields, B < or = 0.5H (perpendicular critical field) the current decreases with further increase of the voltage and a negative resistance is observed. However, the critical vortex velocity at which the current reaches a maximum is found to depend on magnetic field contrary to theory. Dissert. Abstr.

N81-18889 Stanford Univ., Calif.

REFRACTORY SUPERCONDUCTOR S-N-S MICROBRIDGES Ph.D. Thesis

Robert Bruce vanDover 1980 234 p
Avail: Univ. Microfilms Order No. 8103569

Josephson effect devices consisting of two superconducting thin films connected by a non-superconducting metallic bridge are investigated. Theoretical models for the behavior of these devices are developed and used to show that the devices have significant potential for pratical applications. Appropriate fabrication and processing techniques are developed to deal with hard and high critical temperature superconductors. The electrical characteristics of Nb-Au-Nb and Nb-Cu-Nb bridges are described. Critical current resistance products as high as 0.5 mV and resistances up to 0.4 ohm were obtained in experimental devices in substantial agreement with the theoretical model. This model involves a free parameter which characterizes the proximity effect; values inferred from the critical currents of bridges are in reasonable agreement with values inferred from the transition temepratures of S/N bilayers. Typical current voltage characteristics are in good agreement with a simple Time-Dependent Ginzburg-Landau model. At high dissipations agreement is obtained with the usual heating theory (i.e. the normal hotspot model). Dissert. Abstr.

N81-18890 College of William and Mary, Williamsburg, Va.

IMPROVED CHARACTERIZATION OF Si-SiO2 INTERFACES Ph.D. Thesis

Pin Su 1980 140 p
Avail: Univ. Microfilms Order No. 8103586

Silicon is the heart of modern semiconductor devices. The dominance of Si in semiconductor technology depends on the superior quality and properties of thermally grown SiO2 compared with the oxide that can be placed on any other semiconductor. The well established quasistatic and conductance methods used in the study of the Si-SiO2 interface are improved by using an effectively thin composite insulator, low carrier concentration substrates, and most importantly, low level illumination at a wavelength that creates electron hole pairs. The samples investigated had a thermally grown oxide prepared in dry oxygen. They were never exposed to H2 or H2O at an elevated temperature. The composite gate insulator was completed by having an e-gun deposited 250 A layer on LaF3. The resulting interface, subjected to the improved experimental method, yields a wealth of distinctive structure rather than the often reported featureless U-shaped interface-state density. Dissert. Abstr.

N81-18891 Rochester Univ., N. Y.

EXPERIMENTAL STUDIES OF AN ANDERSON LATTICE SYSTEM Ph.D. Thesis

Boyce Hemphill Grier, Jr. 1980 90 p
Avail: Univ. Microfilms Order No. 8104308

The results of a series of experiments on the Ce sub 0.9-x La sub x Th sub 0.1 alloy system including dc static susceptibility, inelastic neutron scattering, and resistivity measurements are presented. This system is characterized by a first order valence transition at low Lanthanum concentration which becomes continuous for x > 0.094. The first order transition temperature T sub 0, taken to be the midpoint of the hysteresis in the susceptibility, varies from 140 K for x = 0.0 to 53 K at the critical point (x sub c = 0.094). The temperature of the inflection point in the susceptibility, also called T sub o, continues to decrease as x is increased beyond 0.094 to approx. 12 K at x = 0.20. For x > 0.20 no inflection point can be identified and the susceptibility becomes Kondo-like, becoming temperature independent for T approaching 0. Susceptibility measurements reveal a very simple relationship between the temperature independent low temperature susceptibility and the transition temperature. Dissert. Abstr.

N81-18892*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.

SECONDARY ELECTRON EMISSION FROM ELECTRICALLY CHARGED FLUORINATED-ETHYLENE-PROPYLENE TEFLON FOR NORMAL AND NON-NORMAL ELECTRON INCIDENCE M.S. Thesis

Paul Arthur Budd Mar. 1981 147 p refs
(Grant NsG-3166)
(NASA-CR-163968) Avail: NTIS HC A07/MF A01 CSCL 20L

The secondary electron emission coefficient was measured

for a charged polymer (FEP-Teflon) with normally and obliquely incident primary electrons. Theories of secondary emission are reviewed and the experimental data is compared to these theories. Results were obtained for angles of incidence up to 60 deg in normal electric fields of 1500 V/mm. Additional measurements in the range from 50 to 70 deg were made in regions where the normal and tangential fields were approximately equal. The initial input angles and measured output point of the electron beam could be analyzed with computer simulations in order to determine the field within the chamber. When the field is known, the trajectories can be calculated for impacting electrons having various energies and angles of incidence. There was close agreement between the experimental results and the commonly assumed theoretical model in the presence of normal electric fields for angles of incidence up to 60 deg. High angle results obtained in the presence of tangential electric fields did not agree with the theoretical models. M.G.

N81-18893*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SUSCEPTIBILITY MEASUREMENTS ON THE SUPERCONDUCTING PROPERTIES OF Nb-Ge ALLOYS

Thomas J. Rathz Jan. 1981 36 p refs

(NASA-TM-82399) Avail: NTIS HC A03/MF A01 CSCL 20L

A susceptibility apparatus to measure superconducting properties of samples made in the MSFC Drop Tube was used to measure the transition temperature (Tc) and susceptibilities of Nb and Nb Ge Alloys prepared in bulk spherical (2-4 mm diameter) form using a 32 m drop tube in which containerless low gravity solidification could take place. Results indicate that a drop tube processing environment was beneficial for increasing the Tc of the superconducting phase of the material over that of arc melted material. The increase in Tc is found to be related to the amount of solidification of the total sample that took place before reaching the bottom of the drop tube. In phase and quadrature phase measurements of the specimen's susceptibility indicated that some improvement in homogeneity takes place in drop tube processing. These phase measurements also indicated little or no shielding of a lower Tc phase by a higher Tc filamentary structure. Author

N81-18894*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EXPERIMENT REQUIREMENTS AND IMPLEMENTATION PLAN (ERIP) FOR SEMICONDUCTOR MATERIALS GROWTH IN LOW-G ENVIRONMENT EXPERIMENT NO. MPS-77F087

Roger K. Crouch, Archibald L. Fripp, William J. Debnam, and Ivan O. Clark Feb. 1981 55 p refs

(NASA-TM-81943) Avail: NTIS HC A04/MF A01 CSCL 20L

Crystals of the intermetallic compound Pb1-xSnxTe will be grown in furnaces on the Space Shuttle. The reasons for conducting this growth in space, the program of investigation to develop the space experiment and the requirements that are placed on the Space Shuttle furnace are discussed. Also included are relevent thermophysical properties of Pb1-xSnxTe to the degree which they are known. S.F.

N81-18895# International Business Machines Corp., Yorktown Heights, N. Y. Thomas J. Watson Research Center.

STUDY OF THE PHYSICS OF INSULATING FILMS AS RELATED TO THE RELIABILITY OF METAL OXIDE SEMICONDUCTOR DEVICES Interim Report, 1 Oct. 1979 - 30 Mar. 1980

J. A. Calise, D. J. DiMaria, D. W. Dong, R. Ghez, and A. Hartstein Nov. 1980 140 p refs

(Contract F19628-78-C-0225; ARPA Order 2180; AF Proj. 2180)

(AD-A093506; RADC-TR-80-317) Avail: NTIS HC A07/MF A01 CSCL 20/12

This report covers the high current injection into SiO2 using Si rich SiO2, the use of Raman scattering to observe amorphous Si in Si rich SiO2 and the crystallization of this amorphous Si at high temperatures, the use of attenuated total reflectance measurements to study Si rich SiO2, measurements of physical characteristics of oxides grown using high pressure oxidation, and the description of an automatic tester developed for use in electron and hole trapping studies. GRA

N81-18896# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

MEASUREMENT OF THE MINORITY CARRIER DIFFUSION RATE IN N-GaAs M.S. Thesis

Gary Alan Bleeker Dec. 1980 96 p refs

(AD-A094402; AFIT/GEO/PH/80-4) Avail: NTIS HC A05/MF A01 CSCL 20/12

A new experimental procedure was developed to directly measure the minority carrier diffusion rate in n-GaAs. A Q-switched Nd-YAG laser was used to excite the sample and the delay between laser excitation and subsequent luminescence of the sample was used to determine the diffusion rate. A mathematical model of carrier diffusion was developed and computer plots generated to predict and analyze the experimental data. With the 4 micron thick sample used, the procedure enabled the researcher to obtain an upper bound in delay time of 350 picoseconds and an approximate diffusion coefficient of 100 sq cm/sec. The spectral components of the luminescence and relative conversion were studied. The luminescent spectra exhibited yet unidentified lines above the band gap energy in addition to the usual set of excitation lines. The conversion efficiency of the laser excitation to photoluminescence was 0.14%. GRA

N81-18897# Oklahoma State Univ., Stillwater.

ELECTRONIC STRUCTURE OF DEFECTS IN OXIDES Final Report, 1 Dec. 1979 - 30 Nov. 1980

Geoffrey P. Summers 1980 21 p refs

(Contract DE-AS05-76ER-04837)

(DOE/ER-04837/7) Avail: NTIS HC A02/MF A01

Details of the electronic structure of F-type centers in the series of oxides SrO, CaO, alpha-Al2O3 and MgAl2O4 were determined using measurements of photoconductivity, luminescence, and fluroescence lifetimes. Measurements were made over the spectral range 2 to 6.5 eV and over the temperature range 4 to 350 K. The centers were introduced into SrO by electron, on proton or neutron bombardment, into CaO and alpha-Al2O3 by electron a neutron bombardment or thermochemical coloration, and into MgAl2O4 by particle bombardment. In some cases, notably CaO and alpha-Al2O3, the photoconductivity behaves differently depending on the method used to introduce the centers. In particular, neutron irradiated and some thermochemically colored samples of sapphire contain an effective electron trap with an optical transition energy of approx. 5.0 eV and a thermal excitation energy of 0.72 eV as determined by measurements of photoconductivity, thermoluminescence and phosphorescence. This trap appears to be a structural defect consisting of an aggregate of anion vacancies. DOE

N81-18898# Sandia Labs., Albuquerque, N. Mex.

FUNDAMENTAL STUDIES OF GRAIN BOUNDARY PASSIVATION IN POLYCRYSTALLINE SILICON WITH APPLICATION TO IMPROVED PHOTOVOLTAIC DEVICES Research Report, Jan. - Jul. 1980

C. H. Seager and D. S. Ginley Aug. 1980 46 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-2461) Avail: NTIS HC A03/MF A01

Calculations were made of the a.c. properties of silicon grain boundaries based on the simple DDL/TE model. Experimental data obtained on bicrystals were shown to be in good agreement with these predictions. The anomalously large values of the low frequency capacitance were shown to be due to modulation of the barrier height by injected charge. Calculations of the properties of illuminated grain boundaries are also detailed and some preliminary conclusions are presented. Several new improved methods for the intorduction of atomic hydrogen into polysilicon are discussed. By using EBIC characterization of polysilicon diodes, it was demonstrated that the hydrogen passivation process not only removes substantial amounts of trapped grain boundary charge, but also eliminates essentially all minority carrier recombination in these regions. Methods for reducing the hydrogen expoaure time necessary to achieve this passivated condition are discussed. DOE

N81-18899# Stanford Linear Accelerator Center, Calif.
DEEP INELASTIC PHENOMENA
C. Y. Prescott Oct. 1980 53 p refs Presented at the 18th Intern. School of Subnucl. Phys., Erice, Italy, 31 Jul. - 11 Aug. 1980
(Contract DE-AC03-76SF-00515)
(SLAC-PUB-2625; CONF-800778-2) Avail: NTIS HC A04/MF A01

Nucleon structure as seen in the context of deep inelastic scattering is discussed. The quark-parton model is examined in relation to lepton-neutron scattering at high energies. Topics covered include scaling; scale breaking and the ideas of quantum chromodynamics; the Q(2) dependence of structure function; moments; and the important parameter R. DOE

N81-18900# California Univ., Berkeley. Materials and Molecular Research Div.
SURFACE ASPECTS OF HYDROGEN PHOTOGENERATION ON TITANIUM OXIDES
F. T. Wagner, S. Ferrer, and G. A. Somorjai Jul. 1980 27 p refs Presented at the ACS Symp. on Photoeffects at Semiconductor-Electrolyte Interfaces, Golden, Colo., 15 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11456; CONF-8010142-1) Avail: NTIS HC A03/MF A01

The effects of surface platinization on photoactivity are discussed and evidence for a thermal reaction between Pd and TiO2 surfaces is given. No Auger detectable changes in surfaces composition correlate with the higher rates of hydrogen photogeneration on metal-free SrTiO3 observed in highly concentrated aqueous alkaline electrolyte. Platinized crystals and photoelectrochemical cells show similar enhancement of photoactivity at high hydroxide concentrations. Although no hydrogen photogeneration is seen from water vapor at pressures up to 20 Torr on crystals near room temperatures, hydrogen photogeneration does occur on prereduced crystals at temperatures where oxygen diffusion into the bulk is rapid. Kinetics of hole transfer or hydroxylation may determine the overall reaction rate at zero applied potential. DOE

N81-18901 Stanford Univ., Calif.
MOESSBAUER SPECTROSCOPY OF THULIUM HYPERFINE INTERACTIONS AND ELECTRONIC RELAXATION WITH A 3He-4He DILUTION REFRIGERATOR Ph.D. Thesis
Ned Stephen Dixon 1980 141 p
Avail: Univ. Microfilms Order No. 8103504

Many important phenomena in solid state physics may be investigated by using the nuclear system as a probe of the electronic system through hyperfine interactions. The Moessbauer effect is a particularly precise and elegant method for extracting such information from the nuclear system. The Moessbauer effect of Tm-169 was used to investigate electronic phenomena in Tm ions such as crystal field effects, electronic relaxation among crystal field states, nonintegral valence states, magnetic order, and Jahn-Teller distortions. The low temperatures necessary for these studies were obtained with a He-3 - He-4 dilution refrigerator. Dissert. Abstr.

N81-18902 Stanford Univ., Calif.
PROBES OF SUPERFLUID HE-3; NMR IN PERIODIC TEXTURES AND THE DRAG FORCE ON NEGATIVE IONS Ph.D. Thesis
David John Bromley 1980 95 p
Avail: Univ. Microfilms Order No. 8103489

Two distinct phases of p wave superfluid He-3 are identified. In the B phase there is no preferred direction for each pair's angular momentum. In the A phase all the pairs line up and the direction of their orbital angular momentum defines a preferred direction L. Two probes of these unusual states of matter are studied. An applied hydrodynamic flow is expected to cause the L vector in the A phase to form a helical spatial texture. This periodic structure leads to a unique nuclear magnetic resonance spectrum that should allow experimental identification. Electrons injected into liquid Helium form relatively large bubble-like states with the electron at their center. These negative ions were dragged through the superfluid phases by electric fields and their velocity was measured. It is shown that simple models explain all the qualitative behavior of the drag force. In particular, the basic physics which explains the anisotropy of the drag force in the A phase is identified. An approach to the problem of impurity scattering in p wave superfluids is presented. Dissert. Abstr.

N81-18903 Stanford Univ., Calif.
TOPICS IN LATTICE FIELD THEORY Ph.D. Thesis
Mark Allen Srednicki 1980 104 p
Avail: Univ. Microfilms Order No. 8103562

Three problems in lattice field theory are discussed. The exact spectrum of the mean spherical model in 1 + 1 dimensions is calculated using a lattice Hamiltonian formulation. This model is equivalent to the O(N) Heisenberg model in the limit N approaches infinity and exists only in a disordered phase. The singularity structure of the theory and implications for both weak and strong coupling approximations are discussed. It is shown that Ising models and Z(2) gauge theories, in any number of dimensions, are equivalent to systems of fermions with local interactions only. This is done in the Hamiltonian formalism by rewriting the Hamiltonian in terms of locally coupled fermion operators. One advantage of the fermionic formalism is that duality transformations become trivial. All unsolved models have products of four or more fermion operators as terms in their Hamiltonians. The lightest magnetic monopoles of the SU(5) grand unified theory are described by introducing new degrees of freedom into the Hamiltonian form of SU(3) color xU(1)cm lattice gauge theory. This allows a description of the properties of these monopoles (which carry color) when the color forces are strong. Dissert. Abstr.

N81-18904 Northwestern Univ., Evanston, Ill.
THEORETICAL STUDIES OF INTERMETALLIC COMPOUNDS: INTRINSIC STRUCTURE, IMPURITIES, AND SURFACE PROPERTIES Ph.D. Thesis
Gregory Allen Benesh 1980 148 p
Avail: Univ. Microfilms Order No. 8104691

A theoretical study of the electronic structure of intermetallic compounds was approached through the independent particle model. Of the different methods that utilize this model, some based on molecular orbital theory were developed to study those electronic properties that depend primarily on the local environment. The molecular cluster method used is of this type; it explicitly treats only a finite volume of the compound which is embedded in a crystal potential representative of the infinite crystal. The electronic structure of the ordered Zintl (B32) phase of LiAl was studied in this molecular cluster model within the framework of the Hartree-Fock-Slater theory. Dissert. Abstr.

N81-18905 Maryland Univ., College Park.
CORE-LEVEL SPECTROSCOPIES OF LIGHT METALS: EFFECTS OF AUGER-ASSISTED EMISSION AND CORE-HOLE BANDING Ph.D. Thesis
Harvey Stephen Gotts 1980 129 p
Avail: Univ. Microfilms Order No. 8103879

The effect of the Auger assisted emission process on the Li X-ray emission spectrum was studied. In this process, the system begins in an initial state containing an unoccupied core level. A transition is made into an intermediate (virtual) state containing the filled core level, an excited Auger electron, and two holes in the conduction band. The final state is reached when the excited Auger electron emits a photon while changing its momentum by a reciprocal lattice vector (umklapp). The effect of banding of the core level due to core hole migration was examined. The core levels of interest for soft X-ray spectroscopies of the light metals are low lying states with little overlap between states on neighboring ions. Consequently it is usually assumed that the core level is very narrow and whatever width it has is due to lifetime and phonon broadening. However, when an electron is removed from a core state in a metal, a net transport mechanism appears other than direct tunneling between sites. Dissert. Abstr.

N81-18906 Louisiana State Univ. and A&M Coll., Baton Rouge.
THE SOLUTION TO SINGLE KINK SOLITARY WAVE TRANSPORT FOR SYSTEMS DESCRIBED BY A GENERALIZED FRENKEL-KONTOROVA EQUATION Ph.D. Thesis
Louis William Adams, Jr. 1980 158 p
Avail: Univ. Microfilms Order No. 8103620

A numerical procedure to solve the differential equation for

solitary waves via iteration for a generalized Frenkel-Kontorova model is presented. The generalization consists of adding a constant force proportional to particle velocity. The equation of motion is cast into integral form using a Green's function. Progress in nonlinear dynamics is reviewed, using the sine-Gordon equation as an example. Emphasis is placed on the concept of 'non-linear modes' and its relevance in theoretical descriptions of transport processes. The generalized Frenkel-Kontorova equation, its dimensionless reparametrization and an outline of the iteration scheme are defined and the continuum approximation of a single kink transport problem is solved. The full discrete case is examined. How this differs from the continuum approximation is discussed as well as why the continuum approximation fails to adequately model aspects of transport processes in such applications as crystal defect propagation and superionic conductors. Dissert. Abstr.

N81-18907 Purdue Univ., Lafayette, Ind.
THEORETICAL INVESTIGATION OF THE TITANIUM SESQUIOXIDE BAND STRUCTURE Ph.D. Thesis
Shannon Gervase Lieb 1980 231 p
Avail: Univ. Microfilms Order No. 8102679

An ab initio calculation of the band structure of titanium sesquioxide has been carried out using the tight binding formalism. To model the essential ingredients of the solid, a simple cluster consisting of the metal and its nearest six oxides is chosen. The cluster Fock elements are brought to self consistency with several physically meaningful constraints imposed on the final solution. These constraints are elevated in terms of the cluster as it resides in the crystal. The potential surfaces in the region of the cluster due to the remainder of the crystal is evaluated by use of a point charge approximation of those ions remaining in the crystal after removing the cluster atoms. This potential is analytically fit and the matrix elements arising among the cluster atoms with this external potential are then evaluated. Together the cluster Fock and external potential matrix elements comprise the crystal Fock matrix. Dissert. Abstr.

N81-18908 Rensselaer Polytechnic Inst., Troy, N. Y.
PHOTOCONDUCTIVITY IN NICKEL-OXIDE Ph.D. Thesis
Michael Gregory Brown 1980 260 p
Avail: Univ. Microfilms Order No. 8103754

The conductivity and the photoconductivity were studied from 4.2 K to 550 K. Single crystal specimens used were obtained by a halide decomposition method or from a flame fused crystal. The study was carried out in the energy range 0.4 eV to 6.2 eV. The onset of the photoconductivity was observed at 2 eV, leading to an edge at approx. 4 eV. Evidence was found for another photoconductivity edge at approx. 6 eV. Fine structure was observed between 2 eV and 3.5 eV which anticorrelated with the crystal field peaks in the optical absorption spectrum. The photoconductivity between 2 eV and 3.5 eV arises from excitations out of the 2p band onto a Ni(+2) ion. The photocurrent was studied as a function of temperature at various optical energies. It decreased rapidiy with decreasing temperature and was generally unobservable at 77 K for all incident energies of light. This indicates that severe trapping and subsequent carrier recombination is occurring. Dissert. Abstr.

N81-18909 Texas Univ. at Arlington.
THE EFFECT OF THIN EPITAXIAL FILMS ON THE EARLY DEFORMATION OF COPPER SINGLE CRYSTALS Ph.D. Thesis
Kothandaraman Sethuraman Ravindhran 1980 192 p
Avail: Univ. Microfilms Order No. 8103768

The film substrate combinations studied were Nickel-Copper, Ruthenium-Copper, Platinum-Copper and Titanium-Tungsten-Copper. The single crystals were characterized by the subgrain size and initial dislocation density. The films were applied by electroplating and sputtering. The interface regions were examined qualitatively by Rutherford Backscattering Spectrometry technique. The presence of the epitaxial films raised the easy glide resolved shear stress and the slope of Stage 1. The extent of easy glide was unchanged. It was proposed that the strengthening in coated crystals resulted from a plastic constraint leading to plastic incompatibility across the interface. Automations diffusion across the interface resulting in an impurity atmosphere at the surface was also proposed as a mechanism to account for the observed strengthening. This was substantiated by Rutherford Backscattering Spectrometry. Dissert. Abstr.

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N81-18910 California Univ., Los Angeles.
ENTROPY STABILITY OF DYNAMIC SYSTEMS Ph.D. Thesis
Joannis Anastasios Phillis 1980 81 p
Avail: Univ. Microfilms Order No. 8102868

The problem of stochastic stability is examined from the point of view of entropy. The concept of entropy is used and conditions for keeping it within certain bounds or minimizing it are sought. For this purpose several tools and results of the theory of stochastic differential equations are used. Systems with constant or periodic coefficients are considered and conditions for entropy stability are developed. The systems are described by Ito equations. The problem is generalized to systems with noise input. A linearization procedure is applied in the general nonlinear case and sufficient conditions for stability are developed. A lower bound for the entropy of the nonlinear case is found which can be useful in determining stability for certain systems. Discrete systems are also examined. The results are parallel to the ones of the continous systems. Several examples illustrate the use of the stability criteria. In particular, the case of a microwave oscillator is considered and rigorous results of stability are developed. Dissert. Abstr.

N81-18911 Washington Univ., St. Louis, Mo.
CONTROL OF QUANTUM SYSTEMS Ph.D. Thesis
Garng M. Huang 1980 99 p
Avail: Univ. Microfilms Order No. 8103711

Quantum mechanical control systems are examined. Following the historical development of quantum mechanics, the quantum control model is obtained from a corresponding classical structure. Second order linear and bilinear control systems as well as first order linear controls systems are investigated; it is further demonstrated that the analysis may be extended to some nonlinear control systems. These results form an interesting example of the general theory of quantization. Also, the local controllability as well as the global controllability conditions for these quantum control systems are developed. These results generalize the concept of the controllability of finite dimensional ordinary differential systems to infinite dimensional partial differential systems. Dissert. Abstr.

N81-18912# Michigan Univ., Ann Arbor.
SOLID-STATE PROCESSES TO PRODUCE HEMISPHERICAL COMPONENTS FOR INERTIAL FUSION TARGETS
K. D. Wise, M. G. Robinson, and W. J. Hillegas 1980 12 p refs Presented at Am. Vacuum Soc. Conf., Detroit, Mich., 13 Oct. 1980
(Contract DE-AC08-78DP-40030)
(CONF-801037-25) Avail: NTIS HC A02/MF A01

The designs proposed for next generation targets and components for inertial fusion (IF) involve complex multilayer, multishell configurations. Solid-state process technology offers a wide assortment of fabrication techniques useful in the realization of such structures. Several such processes which are capable of producing freestanding hemishells of a variety of materials are presented. DOE

N81-18913 Cornell Univ., Ithaca, N. Y.
THE CLASSICAL LIMITS OF P(PHI) SUB 2 QUANTUM FIELD Ph.D. Thesis
Matthew James Donald 1980 56 p
Avail: Univ. Microfilms Order No. 8102959

How the structures of special relativity (particles) and classical

field theory (waves) can be derived as limits, as Planck's constant tends to zero is discussed in the framework of two dimensional Boson field theory in an effort to reveal the mathematical structures behind wave particle duality. The classical limit problem in quantum mechanics is reviewed and a uniform interpretation of classical limit theories as being identifications of states, i.e. elements of the physical Hilbert space, with expectations which satisfy the appropriate classical equation is established. Two classes of states in interacting P(phi) sub 2 theories are identified: one for which the classical equations are those of special relativity and the other for which the classical equation is the nonlinear Klein-Gordon equation. The fundamental theorem of Hepp in quantum mechanics, many body theory, and P(phi) sub 2 models with a space cutoff are considered. Hepp's methods for proving a classical field limit for P(phi) sub 2 models with space cutoff cannot be extended to models without cutoffs and that much more powerful and difficult techniques, in particular the techniques of Euclidean field theory, are required. A cluster expansion is used to prove that a classical field limit exists for any P(phi) sub 2 model with a convex polynomial P. The problem of a classical particle limit for a P(phi) sub 2 theory is introduced. Dissert. Abstr.

N81-18914 Maryland Univ., College Park.
SHORT-RANGE AND LONG-RANGE FORCES IN QUANTUM THEORY: SELECTED TOPICS Ph.D. Thesis
John Richard Hiller 1980 156 p
Avail: Univ. Microfilms Order No. 8103885

Short range forces (SRF) are encountered when the effects of the parity violating (PV) weak neutral current are considered in atomic systems. These and other SRF that are associated with operators that contain delta functions were examined. Identities which convert a delta function matrix element to that of a global operator were reviewed. Past and possible future applications of such identities are described. It was found that use of these identities can substantially improve the results obtained with less accurate wave functions. A further application to the hyperfine structure of the ground state of lithium is presented where results are improved by the use of an identity. As preparation for a calculation concerning PV electric dipole (E1) transitions in helium, a theoretical framework for the calculation of neutral current parity mixing effects in many electron atoms was reviewed. Dissert. Abstr.

N81-18915 Syracuse Univ., N. Y.
RELATIVISTIC HAMILTONIAN DYNAMICS FOR N POINT PARTICLES Ph.D. Thesis
Michael Joseph King 1980 188 p
Avail: Univ. Microfilms Order No. 8104531

The theory is quantized canonically to give a relativistic quantum mechanics for N particles. The existence of such a theory has been in doubt since the proof of the No-interaction theorem. However, such a theory does exist and was generalized. This dynamics is expressed in terms of N + 1 pairs of canonical fourvectors (center-of-momentum variables or CMV). A gauge independent reduction due to N + 3 first class kinematic constraints leads to a 6N + 2 dimensional minimum kinematic phase space, K. The kinematics and dynamics of particles with intrinsic spin were also considered. To this end known constraint techniques were generalized to make use of graded Lie algebras. The (Poincare) invariant Hamiltonian is specified in terms of the gauge invarient variables of K. The covariant worldline variables of each particle were found to be gauge dependent. As such they will usually not satisfy a canonical algebra. An exception exists for free particles. The No-interaction theorem therefore is not violated. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-18916*# National Aeronautics and Space Administration, Washington, D. C.
THE FUSION OF MBB WITH VFW FINALLY BROUGHT TO COMPLETION
Feb. 1981 10 p Transl. into ENGLISH from Sueddeut. Zeitung (West Germany), no. 293, 1980 p 21 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76489) Avail: NTIS HC A02/MF A01 CSCL 05A

Two newspaper type articles describing the final, long awaited unification of the two German Air and Space companies, MBB and VFW are presented. Government participation in this 'fusion' arrangement and the advantages expected to accrue are discussed. T.M.

N81-18917# California Univ., Los Angeles. Congitive Systems Lab.
GODDESS: A GOAL-DIRECTED DECISION STRUCTURING SYSTEM
Judea Pearl, Antonio Leal, and Joseph Saleh Jun. 1980 67 p refs
(Contract N00014-78-C-0372; NR Proj. 197-049)
(AD-A094406; UCLA-ENG-CSL-8034) Avail: NTIS HC A04/MF A01 CSCL 05/10

This report describes a preliminary operational version of a computerized, domain-independent, decision support system which is based on a novel, goal directed structure for representing decision problems. The structure allows the user to state relations among aspects, effects, conditions, and goals, in addition to actions and states which are the basic components of the traditional decision tree approach. The program interacts with the user in a stylized English-like dialogue, starting with the stated objectives and proceeding to unravel the more detailed means by which these objectives can be realized. At any point in time, the program focuses the user's attention on the issues which are most crucial to the problem at hand. The structure used is more compatible with the way people encode knowledge about problems and actions and, therefore, promises to offer the following advantages: judgments and beliefs issued by the user would constitute a more valid representation of the user's experience and the user may be guided toward the discovery of action alternatives he otherwise would not have identified. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N81-18918 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN APPROACH TO AUTOMATIC CHECKING OF SEMANTIC INTEGRITY IN DESIGN DATABASES Ph.D. Thesis
Gilles Marie Emmanuel Lafue 1979 180 p
Avail: Univ. Microfilms Order No. 8100616

Associations between database records and integrity constraints and between database operations and integrity checks are outlined, so that the integrity of records with respect to these constraints can be automatically checked (and to a lesser extent, automatically maintained). One decision related to tolerance of violations before checking concerns the scheduling of checks of records whose values are constrained by other records (the constraining records) when these constraining records are updated. One policy is to check the integrity of the constrained records immediately after the updates (immediate integrity checking). Another policy is to delay this check until the

constrained records are accessed to be used (delayed integrity checking). In case of delayed integrity checking, a message is sent to a message pool (the bulletin board), and when a record is accessed, the bulletin board is searched for messages indicating that the integrity of this record should be checked. A major consideration in choosing between these two policies is the speed of interaction with the database that they imply. Dissert. Abstr.

N81-18919 Stanford Univ., Calif.
ANALYSIS OF COALESCED HASHING Ph.D. Thesis
Jeffrey Scott Vitter 1980 111 p
Avail: Univ. Microfilms Order No. 8103571

The classic problem of how to store information dynamically to allow for quick lockup, frequently encountered in dictionaries, telephone listings, symbol tables for compilers, and storing a company's business records, is considered. Each package of information is stored in computer memory as a record. There is a special field in each record, called the key, that uniquely identifies it. The job of a searching algorithm is to take an input K and return the record (if any) that has K as its key. Hashing is one of the most important solutions to the searching problem, because no matter how many records are stored, the average search times remain bounded. The coalesced hashing method, in which a portion of memory (called the address region) serves as the range of the hash function while the rest of memory (called the cellar 0) is devoted solely to storing records that collide when inserted, is proposed as a solution to the storage problem. The result is an expression of the average search times as a function of the number of records and the cellar size, solving the problem. These formulas are used to pick the cellar size that leads to optimum search performance and it is shown that this tuned method is competitive. Dissert. Abstr.

N81-18920 Stanford Univ., Calif.
KNOWLEDGE-BASED RETRIEVAL ON A RELATIONAL DATABASE MACHINE Ph.D. Thesis
David Elliot Shaw 1980 281 p
Avail: Univ. Microfilms Order No. 8103555

The efficient retrieval of records from very large data bases in applications where the criteria for description matching require a deductive inference over a domain specific knowledge base is described. The approach, while offering considerable power and generality, requires the execution of operations which are quite expensive on a conventional computer system. The solution which involved the design of a specialized non vonNeumann machine, portions of which would be implemented in VLSI, which permits the highly efficient evaluation of certain operators of a relational algebra of particular importance to the computational task of logical satisfaction. The architecture permits an improvement in operators on a conventional computer system and appears to offer significant potential advantages in many practical database management applications. Dissert. Abstr.

N81-18921*# King Research, Inc., Rockville, Md.
NALNET BOOK SYSTEM: COST BENEFIT STUDY
Nancy V. DeWath, Vernon E. Palmour, Joan R. Foley, Madeline M. Henderson, and Cynthia W. Shockley (Online Computer Systems Inc., Germantown, Md.) Jan. 1981 222 p refs
(Contract NASw-3424)
(NASA-CR-164007) Avail: NTIS HC A11/MF A01 CSCL 05B

The goals of the NASA's library network system, NALNET, the functions of the current book system, the products and services of a book system required by NASA Center libraries, and the characteristics of a system that would best supply those products and services were assessed. Emphasis was placed on determining the most cost effective means of meeting NASA's requirements for an automated book system. Various operating modes were examined including the current STIMS file, the PUBFILE, developing software improvements for products as appropriate to the Center needs, and obtaining cataloging and products from the bibliographic utilities including at least OCLC, RLIN, BNA, and STIF. It is recommended that NALNET operate under the STIMS file mode and obtain cataloging and products from the bibliographic utilities. The recommendations are based on the premise that given the current state of the art in library automation it is not cost effective for NASA to maintain a full range of cataloging services on its own system. The bibliographic utilities can support higher quality systems with a greater range of services at a lower total cost. J.M.S.

N81-18922# Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany). Forschungsabteilung Datentechnik.
INTEGRATED INTERACTIVE DESIGN SYSTEM FOR SMALL DATA PROCESSING SYSTEMS Final Report
Jens-Peter Behr, Norbert Dahmen, Ernst-Guenther Petzold, Heinz Schoeneman, Juergen Schwandt, and Rainer Winter Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 173 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-DV-79-11; ISSN-0170-9011) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 36,15

The application of computer aided design techniques during the system definition phase is discussed. A computer method was developed for modeling and simulating system concepts in the design phase. The method uses Petri nets, is written in FORTRAN, may be used on a minicomputer, and has interactive capability. Essential features of the core system are discussed.
Transl. by E.A.K.

N81-18923# Ocean Data Systems, Inc., Rockville, Md.
CONVRT: CREATABASE/RSVP DATA FILE SOFTWARE INTERFACE
R. L. Hall and J. H. Locklin 29 Jul. 1980 87 p
(Contract N00014-77-C-0165)
(AD-A094304) Avail: NTIS HC A05/MF A01 CSCL 09/2

CONVRT is a computer program which provides the capability to interface oceanographic hydrocast data contained in the SEAS Data Bank with the programs RSVP and RETVAL which are used to select and preprocess ocean station data for use by the NORDA suite of acoustic models. CONVRT is a stand-alone program which generates a packed RSVP input data file from a Subset Binary File produced by CREATABASE, the Data Bank storage and retrieval system. This data file reformatting is accomplished in an efficient and uncomplicated mannner with a minimal amount of user interaction. This document is the complete technical and user documentation for CONVRT. It presents a discussion of the software design and implementation and the source level documentation for all components of the program. It also describes the input and output files in detail as well as instructions to the user for the preparation of the input file and the execution of the program. GRA

N81-18924# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
IMPROVEMENT OF ACCESS TO DOD SCIENTIFIC AND TECHNICAL INFORMATION. PART A: BACKGROUND INFORMATION Progress Report, Dec. 1979 - Dec. 1980
Murray E. Kamrass and Vincent J. Berinati Dec. 1980 109 p refs
(Contract MDA903-79-C-0320)
(AD-A094376; AD-E500238; IDA-P-1537-PT-A; IDA/HQ-80-22919) Avail: NTIS HC A06/MF A01 CSCL 05/2

The operations and services of DTIC are discussed along with the regulatory basis for such services and some statistics associated with the present level of service provided by DTIC. Emphasis is placed on the handling of classified material on-line. J.M.S.

N81-18925# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
IMPROVEMENT OF ACCESS TO DOD SCIENTIFIC AND TECHNICAL INFORMATION. PART B: ANALYSES, FINDINGS AND CONCLUSIONS Progress Report, Dec. 1979 - Dec. 1980
Murray E. Kamrass and Vincent J. Berinati Dec. 1980 76 p refs
(Contract MDA903-79-C-0320)
(AD-A094377; AD-E500239; IDA-P-1537-PT-B; IDA/HQ-80-23090) Avail: NTIS HC A05/MF A01 CSCL 05/2

The regulations governing the implementation of DTIC are reviewed and lack of enforcement is found to be a primary factor in denying to DTIC about fifty percent of the information

that should be in the files. A survey of DROLS users indicates that nearly all classified users would be unhappy about a change to a completely unclassified system, although the real benefits of the classified system are small, considering recent and impending improvements to the unclassified system. In addition, an unclassified system would be less expensive to operate for DTIC, the DOD and the users. The question of the value of information is partially addressed in this report, but a definitive answer is not found. The attitude of classified users is that the information they receive is well worth its present costs. For this reason, a completely unclassified on-line system is not recommended. GRA

N81-18926# Naval Postgraduate School, Monterey, Calif.
IMPLEMENTATION OF SEGMENT MANAGEMENT FOR A SECURE ARCHIVAL STORAGE SYSTEM M.S. Thesis
John Timothy Wells Sep. 1980 243 p refs
(AD-A094569) Avail: NTIS HC A11/MF A01 CSCL 09/2

This thesis presents an implementation of segment management for the security kernel of a secure archival storage system. The basis for this implementation is a family of secure, distributed, multi-microprocessor operating systems designed to provide multi-level internal computer security and controlled sharing of data among authorized users. This implementation provides address space management for individual processes, based on segmentation as a memory management scheme. Non-discretionary information security is provided through enforcement of a security policy based on a lattice structure that allows flexibility in representing different security policies; the Department of Defense (DoD) security classification system is the security policy represented in this thesis. Implementation was completed on the ZILOG Z8000 micro-processor. GRA

N81-18927# Syracuse Univ., N. Y. School of Citizenship and Public Affairs.
PUBLIC MANAGERS AND SCIENTIFIC AND TECHNICAL INFORMATION
Barry Bozeman and Elliot Cole Sep. 1980 23 p refs
(Contract N00014-76-C-0912)
(AD-A093136; TR-7) Avail: NTIS HC A02/MF A01 CSCL 05/2

Despite a tremendous influx of information into public agencies and a concern with information processing models of organizations, there is a special variety of information that is often poorly utilized or under utilized -- scientific and technical information (STI). This study of public managers: orientations toward STI, a study based on data gathered from questionnaires mailed to officials of the Canadian government's Environmental Protection Service, seeks to better understand patterns of STI acquisition and sharing and information channel preferences among users of STI. It was hypothesized that three clusters of variables would have predictive value in respect to channel preference and 'gatekeeping': Job Perceptions, Administrative Role, Professionalism. The chief findings can be summarized as follows: (1) Preference for formal channels is associated with a low opinion of co-workers, increased age (independent of administrative responsibility) and high perceived utility for STI; (2) Preference for informal channels outside the organization is associated with membership in professional organizations; (3) Gatekeeping is associated with a low opinion of co-workers, doctoral level degree, high attendance at professional meetings, and specialization. The implications of the findings for designing scientific and technical information systems are discussed. GRA

N81-18928# California Univ., Livermore. Lawrence Livermore Lab.
SOFTWARE OVERVIEW MANUAL
Robert Allen Nov. 1980 16 p
(Contract W-7405-eng-48)
(UCID-18872-Vol-1) Avail: NTIS HC A02/MF A01

A software overview manual is presented for several software packages developed as part of the COMSYS computer teleconference system, an LSI-11 based communications system. The packages were intended to be general purpose software, for use in other LSI-11 based systems besides COMSYS. This manual was written for a programmer who might wish to use some or all of this software in developing such systems. Word processing, small to medium data base storage and query systems, microcomputer networks, and text exiting systems are examples of systems that might exploit this software. Each package is briefly discussed and then how they may be used together in an LSI-11 based system is examined. All of the packages were written in assembly language and all of the user interfaces are callable from Pascal programs. The packages are SADI (Serial Asynchronous Device Interface), FILLIB (File Library), QMSLIB (Queue Management System Library), UTLLIB (Utility Library), and ASNLIB (Asynchronous Library). There is a separate User's Guide for each of these 5 packages which describes in detail the procedures and functions each provides. DOE

N81-18929# Oak Ridge National Lab., Tenn. Regional and Urban Studies Sect.
RIGOROUS, SYSTEMATIC APPROACH TO AUTOMATIC DATA EDITING AND ITS STATISTICAL BASIS
G. E. Liepins Jan. 1981 32 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7126/R1) Avail: NTIS HC A03/MF A01

Automatic data editing the computerized identification and correction (optional) of data errors is considered. The linkage between statistical error analysis and extreme value programming is determined for the special case of certain independence and symmetry conditions; also provided are rigorous proofs of results central to the functioning of the Boolean approach to automatic data editing of coded (categorical) data. In particular, sufficient collections of edits are defined and it is shown that for a fixed objective function the solution to the fields to impute problem is obtainable simply from knowing which edits of the sufficient collection are failed and this solution is invariant of the particular sufficient collection of edits identified. Similarly, disjoint-sufficient collections of edits are defined and it is shown that, if the objective function of the fields to impute problem is determined by what is called the number of involvements in unsatisfied consistency checks, then the objective function will be independent of the disjoint-sufficient collection of edits used. DOE

N81-18930# Royal Netherlands Meteorological Inst., De Bilt. Oceanografisch Onderzoek.
COMPARISON OF ONLINE PROCESSING METHODS OF THE CIC IN HOEK VAN HOLLAND WITH OFFLINE METHODS OF THE ROYAL NETHERLANDS METEOROLOGICAL INSTITUTE (KNMI) [VERGELIJKING VAN DE ON-LINE VERWERKINGSMETHODE VAN HET CIC IN HOEK VAN HOLLAND MET DE OFF-LINE METHODE VAN HET KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT (KNMI)]
E. Bouws Jan. 1980 8 p refs In DUTCH
(KNMI-V-339) Avail: NTIS HC A02/MF A01

Two on-line procedures were compared to off-line procedures in the measurements of wave heights (Hs) and low frequency wave energy (E 10) in the North Sea. Results of the measurements are either recorded by punched tape or by telex. Values of both systems were correlated and compared.
Transl. by E.D.K.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N81-18931# Policy and Management Associates, Inc., Boston, Mass.
THE EFFECT OF ECONOMIC REGULATION ON FUELUSE EFFICIENCY IN PRIVATE TRUCKING-OPERATIONS Final Report
Apr. 1980 105 p refs
(Contract DOT-OS-90023)
(PB81-114753; DOT-P-50-37) Avail: NTIS HC A06/MF A01 CSCL 05C

Private trucking operations are a substantial component of the motor carrier industry. The description of private carriage covers: magnitude and growth; reasons for use; traffic characteristics; fleet operations; relations with other modes; and the effect of the regulatory system on private trucking operations. An

analysis of how regulations affect private trucking fuel use efficiency and an attempt to forecast the effects of regulatory change are included. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N81-18932*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

RESEARCH AND TECHNOLOGY 1980 Annual Report

Oct. 1980 8 p

(NASA-TM-82260) Avail: NTIS HC A02/MF A01 CSCL 05B

Topics are divided into three major areas: Earth resources, advanced development, and technology transfer. Topics include: aerial color infrared photography, fiber optics, lightning research, soil mechanics, corrosion prevention, image processing, and communication systems development. T.M.

N81-18933*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A METHODOLOGY FOR FOSTERING COMMERCIALIZATION OF ELECTRIC AND HYBRID VEHICLE PROPULSION SYSTEMS

Pierre A. Thollot and Norman T. Musial Oct. 1980 14 p refs (Contract EC-77-A-31-1044)

(NASA-TM-81575; E-545; DOE/NASA/1044-10) Avail: NTIS HC A02/MF A01 CSCL 13F

The rationale behind, and a proposed approach for, application of government assistance to accelerate the process of moving a new electric vehicle propulsion system product from technological readiness to profitable marketplace acceptance and utilization are described. Emphannsis is on strategy, applicable incentives, and an implementation process. T.M.

N81-18934*# National Aeronautics and Space Administration, Washington, D. C.

THE PLACE OF SPACE TECHINOLOGY IN ECONOMIC DEVELOPMENT: REFLECTIONS ON PRESENT AND FUTURE ASPECTS

A. Lebeau and K. E. Reuter Dec. 1980 29 p refs Transl. into ENGLISH from "La Place Techniques Spatiales dans le Developpement Economique: Relexion sur des Aspects Actuels et Futurs" Paris, 1980 p 28 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by ESA, Paris

(Contract NASw-3199)

(NASA-TM-76446) Avail: NTIS HC A03/MF A01 CSCL 05A

The effects of the development of satellite applications on the orientation of the space effort were examined. The gap between available and exploited technology, the impact of the current economic climate and future trends are discussed. Europe's low level of public funding for its space effort, in comparison to other space powers, and the dangers of complacency regarding Europe's competitiveness in the space market are illustrated. A proposal for the general direction which Europe's future strategy must take if European independence in this field is to be preserved is presented. T.M.

N81-18935*# Mechanical Technology, Inc., Latham, N. Y.

ADVANCED PROPULSION SYSTEM CONCEPT FOR HYBRID VEHICLES

Suresh Bhate, Hsin Chen, and George Dochat Dec. 1980 169 p refs

(Contracts DEN3-92; EC-77-A-31-1044)

(NASA-CR-159772; DOE/NASA/0092-80/1; MTI-80TR25) Avail: NTIS HC A08/MF A01 CSCL 13F

A series hybrid system, utilizing a free piston Stirling engine with a linear alternator, and a parallel hybrid system, incorporating a kinematic Stirling engine, are analyzed for various specified reference missions/vehicles ranging from a small two passenger commuter vehicle to a van. Parametric studies for each configuration, detail tradeoff studies to determine engine, battery and system definition, short term energy storage evaluation, and detail life cycle cost studies were performed. Results indicate that the selection of a parallel Stirling engine/electric, hybrid propulsion system can significantly reduce petroleum consumption by 70 percent over present conventional vehicles. J.M.S.

N81-18936# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

OVERVIEW OF RAIL TRANSIT FARE COLLECTION Final Report

Louis D. Rubenstein, James E. Land, Govind Deshpande, and Barry Harrow Aug. 1980 150 p refs

(Contract DOT-AT-80015)

(JPL-PUB-80-89; UMTA-CA-06-0116-80-1) Avail: NTIS HC A07/MF A01

The performance of rail transit fare collection equipment was assessed. Options in fare collection were illustrated by examining four transit systems. Reliability data, in terms of transactions per failure, were gathered for elements of these systems. Detailed investigations and subsystems failure analyses were conducted for two graduated, distance related fare systems. Several models were developed for evaluating the impact of equipment reliability on operating costs and passenger delays. The models utilized the binomial probability distribution to calculate the incidence of simultaneous machine failures as a parameter in multiserver queueing and delay frequency models. Significant findings were that the reliability of distance related fare collection equipment could be improved by: (1) using procurement methods appropriate for development contracts; (2) reducing desirable but nonessential functional requirements in specifications; (3) providing more precise descriptions of field operating environments; and (4) use of reliability criteria that distinguish between component replacement and the clearing of temporary blockages. It was also found that fare collection operating and maintenance costs account for 7 to 31 percent of revenues collected. J.M.S.

N81-18937# European Space Agency, Paris (France).

ECONOMIC EFFECTS OF SPACE AND OTHER ADVANCED TECHNOLOGIES

T. D. Guyenne, ed. and G. Levy, ed. Sep. 1980 266 p refs Partly in ENGLISH and FRENCH Proceedings of ESA/Strasbourg Univ. Intern. Colloq., Strasbourg, 28-30 Apr. 1980 Prepared in cooperation with Strasburg Univ. Sponsored by Council of Europe

(ESA-SP-151; ISSN-0379-6566) Avail: NTIS HC A12/MF A01

The effects of innovation and the economic impact of aerospace technology and technology transfer were discussed. The papers are grouped under: methodology and problems, results and applications, and future perspectives. Questions of computer related unemployment, analysis of economic returns from research and development expenditures, and the identification of economic benefits from technology transfer are discussed. For individual titles, see N81-18938 through N81-18961.

N81-18938# European Space Agency, Paris (France).

SPACE ACTIVITIES AND ECONOMIC FORCES

Andre Lebeau *In its* Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 21-34 In ENGLISH and FRENCH (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01

The present uses of space, the evolution of space technology and its probable effects, the growth limits to space activities, and the competitive role of Europe in relation to developments in space technology are reviewed. The possibilities of manned intervention in orbit, of returning heavy payloads from orbit, and reduction of launch costs are discussed relative to the design of orbital systems and materials science. Author (ESA)

N81-18939# Ministere de l' Industrie et de la Recherche, Paris (France).

TECHNOLOGY AND ECONOMIC DEVELOPMENT: THE FUTURE OF THE INDUSTRIAL WORLD

Andre Giraud *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 37-43 In ENGLISH and FRENCH (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01

A broad analysis of the interactions between technology development and economic growth as well as social impact and technology transfer is presented. Particular reference to space technology applications is made. Included are some considerations on the importance of international cooperation and on the industrial scene of the future. Author (ESA)

N81-18940# Strasbourg Univ. (France).

GENERAL REFLECTIONS ON THE THEME OF INNOVATIONS

Nicholas Georgescu-Roegen *In* ESA Econ. Effects on Space and Other Adv. Technol. Sep. 1980 p 47-51 refs (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01

Technological innovation or 'exosomatic mutation' is analyzed in a historical context. The difficulties of recognizing future trends with special reference to the energy crisis are discussed. The steam engine rescued man from a crisis similar to the present one. The breeder reactor is mentioned as an invention of the same importance. Author (ESA)

N81-18941# Pennsylvania Univ., Philadelphia.

MEASURING THE SOCIAL AND PRIVATE RATES OF RETURN FROM INNOVATIONS

Edwin Mansfield *In* ESA Econ. Effects on Space and Other Adv. Technol. Sep. 1980 p 53-59 refs (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01

A technique for estimating the social and private rates of return from investment in industrial innovations is described. The results of seventeen case studies, each of which estimates the social and private rate of return from the investment in a particular industrial innovation, are reported. A model is used to compute the consumer's surplus due to the lower price, the resource saving and the corresponding increase in output elsewhere in the economy. It is shown that the social rate of return is consistently greater than the private rate of return. Author (ESA)

N81-18942# California Univ., Los Angeles.

INTEGRATED POLICY ANALYSIS OF ADVANCED TECHNOLOGIES

Michael D. Intriligator *In* ESA Econ. Effects on Space and Other Adv. Technol. Sep. 1980 p 63-70 refs (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01

Simulation of the effects of different policy configurations is performed using an integrated policy analysis framework and an iteration of the policy choices and simulated effects between policy maker and model builder until a desired policy configuration is identified. The integrated policy analysis framework is one involving an interacting socio-demographic core, economic module, science and technology module, environmental and natural resources module, and political and legal systems module. Applications to advanced technologies are presented. Three approaches to policy evaluation using an econometric model are described: the instruments targets approach, the social welfare function approach, and the simulation approach. The last of these, simulation, is emphasized as part of the integrated policy analysis framework. Author (ESA)

N81-18943# Institut de Recherche en Economie de la Production, Paris (France).

ADVANCED TECHNOLOGIES: OBSOLESCENCE; EMPLOYMENT [TECHNOLOGIES DITES DE POINT: OBSOLESCENCE, EMPLOI]

Jacques deBandt *In* ESA Econ. Effects on Space and Other Adv. Technol. Sep. 1980 p 71-77 refs In FRENCH (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01

A definition of the term advanced technologies is presented and the social impact of technological innovation on the obsolescence of existing production machinery and unemployment is discussed. A distinction is made between innovation creating a new product and innovation increasing the production efficiency of an existing product. It is concluded that the impact of technology on the social crisis is conditioned by other factors and policies. Technological innovations in the electronics industry are discussed. It is pointed out that while employment is reduced in some sectors, growth is observed in peripheral areas. Author (ESA)

N81-18944*# National Aeronautics and Space Administration, Washington, D. C. Office of External Relations.

THE IMPACT OF NASA RESEARCH AND DEVELOPMENT EXPENDITURES ON TECHNOLOGICAL INNOVATION AND THE ECONOMY

Henry R. Hertzfeld *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 81-94 refs (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01 CSCL 05A

Various measures of the economic impact of NASA on the U.S. economy are examined. Macroeconomic analyses, microeconomic analyses, and actual data from NASA program offices are analyzed for their strengths, weaknesses, and results. Each of the measures presented reveals very positive impacts of NASA research and development on the productive capacity of the economy. Data are also presented which document the relative short time span between research and development funding and the realization of economic benefits. A plan for future NASA studies in further documentation and verification of these effects is outlined. Author (ESA)

N81-18945# Strasbourg Univ. (France). Bureau d'Economie Theorique et Appliquee.

THE ECONOMIC EFFECT INDUCED BY EUROPEAN SPACE AGENCY CONTRACTS [LES EFFECTS ECONOMIQUES INDUITS DES CONTRATS DE L'AGENCE SPATIALE EUROPEENE]

Patrice Brendle, Patrick Cohendet, and Regis Larue Detournemine *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 95-102 refs In FRENCH (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01

The 128 firms responsible for 87% of ESA contracted expenditures between 1964 and 1977 were surveyed. Managers were asked to provide an estimate of the situation in their business had they not recieved the ESA contract. The effects accruing in the areas of technology, increased sales management techniques, productivity, and personnel are shown graphically. Notable positive correlations were found. Author (ESA)

N81-18946# Sussex Univ., Brighton (England). Science Policy Research Unit.

THE ECONOMIC EFFECTS OF BIG SCIENCE: THE CASE OF RADIO ASTRONOMY

John Irvine and Ben R. Martin *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 103-116 refs Sponsored by Social Sci. Res. Council (For primary document see N81-18937 09-85)

Avail: NTIS HC A12/MF A01

Two main types of economic effects associated with research, i.e., technological spin-off (for which five different forms are distinguished) and manpower training benefits are identified. The case of British radio astronomy is studied, examining how important each of the types of economic benefit has been. The empirical results presented suggest that manpower training benefits have probably been more important than technological spin-off. The development of parametric amplifiers was shown to be stimulated by contracts let for radio telescope instrumentation. Author (ESA)

N81-18947# State Dept., Washington, D. C.
ECONOMIC POTENTIAL OF RESEARCH AND DEVELOPMENT IN SATELLITE COMMUNICATIONS
S. Ahmed Meer *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 117-127 refs (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

The impact of U.S. civilian satellite communications research programs is reviewed and the potential for private sector investment for future research and development assessed. Systems analysis and market studies on future fixed satellite communications at 20 to 30 GHz and land mobile satellite communication at 800 MHz are presented. The large economic potential forecast by these studies combined with the historic perspective argues for continuation of a federal role in research and development in satellite communications. Author (ESA)

N81-18948# Commission of the European Communities, Brussels (Belgium).
EMPLOYMENT AND NEW MICROELECTRONIC TECHNOLOGY
David M. White *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 131-134 refs (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

An analysis of the social impact of microelectronics is presented which suggests that although there are many areas of uncertainty, employment as a whole is unlikely to be seriously reduced if the new technology is adopted. However, certain areas of employment are bound to be seriously affected and other areas of concern include working conditions and skills. The ameliorating effects of the time scale of the changes in employment are pointed out, using the example of agricultural workers. Between 1960 and 1980, nine million jobs in the European Community were lost (50%), but the social costs have generally been absorbed. Listed are a number of points which form the basis on which to develop the social aspects of policy to ensure that adoption of new technology leads to general social advance. Author (ESA)

N81-18949# Metallgesellschaft, A.G., Frankfurt am Main (West Germany).
MICROELECTRONICS: A NEW DIMENSION IN TECHNOLOGICAL CHANGE IN AUTOMATION
Guenther Friedrichs *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 135-144 refs (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

The social and economic impacts of automation are reviewed, specifically the use of microelectronics in industry. Labor and capital savings in various sectors as a consequence of automation are analyzed. Trends are examined and it is concluded that a serious unemployment problem is developing. Data are shown for the plastics industry, office and data processing machines industry and for manufacturing and mining, relating the introduction of labor saving devices to job loss. Some employment growth is the forecast in education research and development, social services, hotels and restaurants, and transportation. Reduction of the work week and education are seen as the main solution to the problem of job loss.
Author (ESA)

N81-18950# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
A METHOD FOR QUANTIFYING THE EFFECTS OF RESEARCH, DEVELOPMENT AND MECHANIZATION ON ECONOMIC GROWTH: SOME CALCULATIONS FOR THE NETHERLANDS
J. H. Spaa *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 145-151 refs (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

The hour index number, defined as the quotient of the price index number and the index number for the gross hourly wage, is a rough measure of the number of hours required to make and sell a product and to construct the equipment necessary for production and distribution. For most products the hour index number decreases over time. The highest decrease in the hour index number is found for products of industries in a competitive environment and with their own research, development and mechanization (RDM) programs. Discounted rates of return values can be derived for the economic effect of RDM which are comparable with those found by other methods. Models can be constructed by looking for product outputs in terms of the number of items produced by a specific labor force; the increase is then understood as being the effect of RDM. The effect of RDM can then be described as the creation of an imaginary labor force which does not imply cost. In some cases it can also be interpreted as the tapping of imaginary sources of energy and raw materials which do not imply availability or environmental problems.
Author (ESA)

N81-18951# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
EXAMPLE OF A FAVORABLE POLICY FOR SPACE TECHNOLOGY TRANSFER TO OTHER FIELDS [EXEMPLE D'UNE POLITIQUE DE VALORIZATION DE RETOMBEES TECHNOLOGIQUES SPATIALES DANS D'AUTRES DOMAINES]
Didier G. Compard *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 153-168 In FRENCH (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

The technology transfer policy of an aerospace industry is described. Several examples, including kinetic energy storage, the SOPHOCLE program for solar energy conversion, the SYSCOMORAM medical data acquisition and data processing system, industrial safety programs, and new materials applications are cited. The benefits of planning for technology transfer include diversification of risks, faster response to changing markets, establishment of new clients, and improving the public image of the company. Author (ESA)

N81-18952# Engins Matra, Velizy (France). Div. Espace.
HOW SPACE ACTIVITIES AFFECT AN INDUSTRIAL GROUP [PLACE DE L'ESPACE DANS UN GROUPE INDUSTRIEL]
Noel Mignot *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 169-171 In FRENCH (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

The aerospace market, the personnel required as well as their career profiles, and the technology and products involved in the space activities of an industrial company are discussed. The high cost of placing material in orbit dictates the need for the best technology, which is equated with the hiring of young engineers and those from the best schools. These individuals diffuse through the organization bringing the new technologies with them. This is held to be one of the most important interactions of aerospace industry with other industrial activities.
Author (ESA)

N81-18953# Eurosat S.A., Geneva (Switzerland).
SPACE AND METEOROLOGY: AN INTRICATE COST/BENEFIT RATIO
Jean B. Lagarde *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 175-183 (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

The correlation between the costs of establishing, maintaining, and using meteorological satellite systems, and the benefits accruing to all sectors of economic activity in a given geographic area is identified. Improvements attributed to Meteosat-type satellites in the period 1979-1990 are examined. Results show that a conservative estimate of the benefits to be expected in Europe from the operational use of meteosat-type satellites exceeds the corresponding expenditures by a factor of three and in certain countries by as much as four to seven.
Author (ESA)

N81-18954# ECON, Inc., Princeton, N. J.
THE ECONOMIC VALUE OF IMPROVED AGRICULTURAL INFORMATION: A CASE STUDY FOR THE ASSESSMENT OF A EUROPEAN REMOTE SENSING SATELLITE SYSTEM
Francis M. Sand and Franz Jaskolla (Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung) *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 185-190 refs

Sponsored by ESA (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

The case study which provides a preliminary assessment of the performance and economic benefits of a European remote sensing satellite system for agricultural applications is discussed. *An analytical approach to the economic theory of the value of* improved information is presented. The measurement of economic benefits of the satellite is derived from the optimized decisions *on production and distribution of cereals and feed commodities.* Through the use of a dynamic program model, the improved decisions are compared with the decisions which would have *been made under existing agricultural information. A performance* assessment based on remote sensing data from LANDSAT and aircraft on European agricultural test sites is discussed. The classification accuracies obtained are integrated into an agricultural information system for subsequent economic assessment.

Author (ESA)

N81-18955# Commission of the European Communities, Brussels (Belgium). *Forecasting and Assessment in Science and* Technology.

EUROPE IN FACE OF THE FUTURE [L'EUROPE FACE AUX FUTURS]

Michel Godet *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 191-197 refs In FRENCH (For primary *document see N81-18937 09-85)*
Avail: NTIS HC A12/MF A01

Trends toward increased productivity and increased energy *costs are examined and the social and economic impact on* Europe is analyzed. Present limitations in forecasting, the price of energy and its relation to new development, unemployment *as a consequence of automation, the relative position of developed* and underdeveloped countries, and the desirability of social and economic policies are discussed. Author (ESA)

N81-18956# Virginia Univ., Charlottesville.

SPACE RESEARCH AND CLAIRVOYANCE

Roger Sherman *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 199-205 refs (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

Studies of the economic effects of aerospace research and *development are reviewed. Measurable benefits are difficult to* demonstrate, but important advances in scientific knowledge resulted. Gains to be made from broadly organized multination *space efforts are mentioned. Besides the capacity to achieve* technological progress in general, multinational organization of space research may help to maintain priority for scientific over *political aims.* *Author (ESA)*

N81-18957# ECON, Inc., Princeton, N. J.

ECONOMIC POTENTIAL OF EUROPEAN SPACE PROGRAM INITIATIVES IN THE 1980'S: THE NEED FOR LARGE SCALE INITIATIVES

Klaus P. Heiss In ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 207-217 refs (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

Key points concerning European as well as world wide space program initiatives in the 1980's are analyzed. The economic *impact of aerospace research and development in the United* States is discussed, comparing the net trade position of industries. The aerospace efforts of Europe and the U.S. are compared. The major space program opportunities are examined, including global information systems, large space structure capabilities after the Space Shuttle system becomes operational, space as an energy base, and likely phases of space industrialization.

Author (ESA)

N81-18958# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.

AN ESTIMATION MODEL OF ECONOMIC EFFECTS DERIVING FROM CHOICE OF SPACE TECHNOLOGY APPLICATIONS [TENTATIVE D'ESTIMATION DES EFFECTS ECONOMIQUES DANS LES CHOIX DE RETOMBEES TECHNOLOGIQUES SPATIALES]

Jean-Michel Contant *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 221-225 refs In FRENCH (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

A model of technology transfer was developed to help in aerospace technology transfer decision making. Quantitative and qualitative indicators are used to characterize various decision *factors, such as transformation of production facilities, financing* requirements, human factors, economic analysis and market analysis. Further work to develop a more satisfactory model is *deemed necessary. Feed back from the accounting system is* suggested to provide data for improving model results.

Author (ESA)

N81-18959# B and W Elektronik A.S., Aarhus (Denmark).

FROM SPACE METHODOLOGY TO CONSUMER PRODUCTS

K. Stockholm *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 227-231 refs (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

Spin-off from development and production of electronic equipment under ESA contracts is considered. Some of these methods, particularly quality control, safety analysis and process *control, were found to be useful tools in other branches of* development and production programs. It is noted how the experience from the methods learned via ESA programs is *communicated to other companies in Scandinavia by lectures,* papers at conferences, and participation in working groups. Examples cited include a process for coating aluminum parts, a *plating through process for circuit boards, and a production* problem in an audio system. Author (ESA)

N81-18960# Strasbourg Univ. (France).

PHOTONICS: STATE OF THE ART AND FORESEEABLE ECONOMIC DEVELOPMENT [LA PHOTONIQUE: ETAT ACTUEL ET DEVELOPPEMENT ECONOMIQUE PREVISIBLE]

P. Meyrueis (ENSAIS, Strasbourg) and M. Grossmann *In* ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 233-236 In FRENCH (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

Examples of the commercial exploitation of lasers, fiber optics, photovoltaic conversion and optical data acquisition and display devices by the U.S. and Japan are listed and compared with the level of development in Europe. The use of lasers in manufacturing, optical readers and in printers, fiber optics TV systems, cameras and measuring instruments based on CCD's is mentioned. The existence of a fundamental expertise in optics is cited, but the means of technical training must be improved before industrial development in these areas reaches that of the U.S. and Japan. Author (ESA)

N81-18961# Siena Univ. (Italy).

GENERAL REFLECTIONS

Mario Amendola In ESA Econ. Effects of Space and Other Adv. Technol. Sep. 1980 p 239-247 In ENGLISH and FRENCH (For primary document see N81-18937 09-85)
Avail: NTIS HC A12/MF A01

The concept 'advanced technology' is defined and possibilities for the evaluation of the impact of technical progress are examined. *How an actual economy can react to innovative technology is* considered, including the creative aspect, i.e., the impact of space programs on the productive capacity of the economy. Problem engendered by unemployment and an investment/consumption approach to judging innovation are brought out. As an example of the pattern of diffusion of innovation, the case of microelectronics is cited. Finally, technology and dualism are pondered in the sense that technologically affluent regions exist side by side with backward regions, especially in Europe. Author (ESA)

N81-18962# California Univ., Livermore. Lawrence Livermore Lab.

INDUCTIVE ENERGY TRANSFER IN TRANSPORTATION

Carl E. Walter and John D. Salisbury 8 Nov. 1980 31 p refs Presented at the 4th UMTA R and D Conf., Norfolk, Va., 21 Nov. 1980
(Contract W-7405-eng-48)
(UCRL-85141; CONF-801162-1) Avail: NTIS

HC A03/MF A01

The use of inductive energy transfer system in transportation systems is reviewed. An inductive energy transfer system has an energy source consisting of insulated electrical conductors placed beneath the surface of a roadway, aligned with the direction of travel and fed a relatively high alternating current. A vehicle, e.g., car, bus, or rail car, is equipped with a coil suitably wrapped around magnetic material and suspended beneath the vehicle a short distance from the road surface. The ac in the energy source produces an alternating magnetic field which couples inductively with the power pickup coil under the vehicle and results in vehicle propulsion. Investigations of this energy source for transportation in the US have considered the effect of its use on petroleum fuel consumption, system design and operation factors, adaptability to city and highway transportation, vehicle performance, and assessment of the application of this system to automobiles carrying auxiliary battery power equipment. These studies are briefly described. DOE

N81-18963# Industrial Technology Research and Development Foundation, Inc., Durant, Okla.

UNIVERSITY BUSINESS ASSISTANCE CENTER OF OKLAHOMA Final Report

Oct. 1980 115 p refs Prepared in cooperation with Spearhead Associates, Inc., Muskogee, Okla.

(Grant EDA-08-06-02117)

(PB81-109522; EDA-80-0152) Avail: NTIS HC A06 A01 CSCL 05A

The Industrial Technology Research and Development Foundation, Inc. (ITRAD) was established in to address technology innovation transfer and commercialization as a means of accelerating the industrial innovation process. The objective of ITRAD is to make technical expertise and financial assistance available, in approved situations, to small and minority technology based firms for the development and commercialization of new products and processes. The stimulation of new product development and commercialization would create jobs in manufacturing sales, services, and thereby contributing to a healthier economy for the State and region. The ITRAD innnovation Center and its method of operations is defilned. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-18964*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

STUDIES AND OBSERVATIONS OF ULTRAVIOLET AND X-RAY SOURCES Final Report, 1 Jan. - 31 Dec. 1980

Herbert Gursky, Margaret Geller, and Giuseppina Fabbiano Feb. 1981 8 p

(Grant NAG5-5)

(NASA-CR-163969) Avail: NTIS HC A02/MF A01 CSCL 03A

The status of research undertaken with the IUE satellite for programs on strong binary X-ray stars and X-ray globular clusters is summarized. Variable Seyfert galaxies and cataclysmic variables were investigated. T.M.

N81-18965# Florida Univ., Gainesville. Dept. of Physics.

SUPERNOVA EXPLOSIONS: THE ROLE OF A RAYLEIGH-TAYLOR INSTABILITY

J. R. Buchler, Mario Livio, and Stirling A. Colgate (LASL) Los Alamos, N. Mex. LASL 1980 8 p refs Presented at the LAU Colloq. No. 58, Stellar Hydrodynamics, Los Alamos, N. Mex., 12-15 Aug. 1980

(Contract W-7405-eng-36; Grant NSF AST-79-20024)

(LA-UR-80-3231; CONF-800872-18) Avail: NTIS HC A02/MF A01

A two dimensional hydrodynamic study indicates that convectively unstable gradients which develop during core collapse and bounce give rise to large scale core overturn. It is shown that the concomitant release of neutrinos can deposit large amounts of energy and momentum in the infalling envelope and give rise to a powerful supernova explosion. DOE

N81-18966# Joint Inst. for Lab. Astrophysics, Boulder, Colo.

PULSATIONS OF THE R CORONAE BOREALIS STARS

J. P. Cox, D. S. King (New Mexico Univ., Albuquerque), A. N. Cox (Los Alamos Scientific Lab.), J. C. Wheeler, C. J. Hansen, and S. W. Hodson (Los Alamos Scientific Lab.) 1980 7 p refs Presented at 58th Intern. Astron. Union Colloq. on Stellar Hydrodyn., Los Alamos, N. Mex., Aug. 1980 Submitted for publication

(Contract W-7405-eng-36)

(LA-UR-80-3232; CONF-800872-17) Avail: NTIS HC A02/MF A01

The radial pulsations of very luminous, low mass models (L/M approx. 10,000) solar units, which are possible representatives of the R CrB stars, were examined. These pulsations are extremely nonadiabatic. There are in some cases at least one extra (strange) mode which makes interpretation difficult. The blue instability edges are also peculiar in that there is an abrupt excursion of the blue edge to the blue for L/M sufficiently large Cepheid-like pulsations of actual R CrB stars. DOE

N81-18967# Los Alamos Scientific Lab., N. Mex.

RR LYRAE AND BL HERCULIS VARIABLES

Arthur N. Cox 1980 8 p refs Presented at the IAU Colloq. no. 58, Stellar Hydrodyn., Los Alamos, N. Mex., Aug. 1980

(Contract W-7405-eng-36)

(LA-UR-80-2814; CONF-800872-14) Avail: NTIS HC A02/MF A01

The RR Lyrae variables are currently believed to have masses between about 0.5 and 0.8 M/sub solar mass/, effective surface temperatures between 6350 and 7500 K, radii from about 4.0 to 6.0 R/sub solar mass/ and luminosities between log L/L/sub solar mass/ of 1.5 and 2.0. Since they are found in population II locations, they generally have Y = 0.3 and Z = .001, but there are exceptions for both higher Z like the Sun and lower Z like 0.0002. In globular clusters, the periods range from 0.25 to 0.45 day for the first overtone pulsators and 0.40 to 0.80 day for those in the fundamental mode, depending on their luminosity. At transition lines, discussed in detail, the switch from fundamental to first overtone, or vice versa, involves a period change factor of about 0.74 to 0.75. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-18968# Los Alamos Scientific Lab., N. Mex.

ONE DIMENSIONAL HYDRODYNAMICS OF ASTEROID-NEUTRON STAR COLLISIONS

Michael J. Newman and Arthur Nelson Cox 1980 5 p refs Presented at the IAU Colloq. no. 58, Stellar Hydrodyn., Los Alamos, N. Mex., 12-15 Aug. 1980

(Contract W-7405-eng-36)

(LA-UR-80-2871; CONF-800872-12) Avail: NTIS HC A02/MF A01

Results are presented of simplified one dimensional hydrodynamic-radiation diffusion calculations of the tidal breakup of a solid body approaching a neutron star in central impact. Special emphasis was placed on cosmic rays. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-18969 *California Univ., Los Angeles.*

THE BULK COMPOSITION OF IRON METEORITE PARENT BODIES Ph.D. Thesis

John Willis 1980 222 p

Avail: Univ. Microfilms Order No. 8104047

Over 100 iron meteorites were analyzed for As, Au, Co, Cr, Fe, Ga, Ir, Ni, Re, Sb, and W by instrumental neutron activation analysis. Because the sizes and shapes of the samples varied, a scheme was developed to correct for activity differences between samples and flux monitors due to neutron self shielding, detector-to-sample distance, and gamma ray self absorption. The correction scheme consists of two factors, both empirically determined. The first factor is energy dependent and is calculated from the ratio of the low to high energy Fe peaks. The second factor normalizes the data so that the INAA Fe concentration and the known Fe concentration for a particular meteorite agree. The INA data indicate that five previously studied irons having very high Ge/Ga ratios belong together as a new group (IIF).

Dissert. Abstr.

N81-18970 *Alabama Univ., Huntsville.*

REMOTE INFRARED SENSING OF EARTH-APPROACHING ASTEROIDS USING SUN-ORBITING SATELLITE SENSORS Ph.D. Thesis

Norman George Dennis 1980 253 p

Avail: Univ. Microfilms Order No. 8103975

Of asteroids over 100 meters diameter, it is estimated that over 150,000 approach closely to the Earth and only 30 are known. Four important issues of communication system engineering were examined. The first was the development of simple first order equations for the detection range of asteroids using the traditional but approximate concept of normalized detectivity D of an infrared detector; the limited accuracy of the concept is discussed. The second topic was the rigorous application of the techniques of modern mathematical statistics to phonon counting and, thereby, achievement of better discrimination and range capability. Thirdly, there is analysis of the probability distributions of range and signal to noise ratio of the entire visible track of an asteroid. Finally there are recommendations concerning the radio telemetry links.

Dissert. Abstr.

N81-18971*# National Aeronautics and Space Administration. *Ames Research Center, Moffett Field, Calif.*

PIONEER: FIRST TO JUPITER, SATURN, AND BEYOND. BIBLIOGRAPHY

1980 30 p Supplement to NASA-SP-446

(NASA-TM-81233) Avail: NTIS HC A03/MF A01 CSCL 03B

The reference citatons are grouped by experiment. Experiments include: the charged particle instrument experiment; the ultraviolet photometer experiment; imaging experiments; and magnetometer experiments. The asteroid detector experiment and the plasma analyser experiment are also included.

T.M.

N81-18972*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

PLASMA WAVES NEAR SATURN: INITIAL RESULTS FROM VOYAGER 1 Progress Report

D. A. Gurnett, W. S. Kurth, and F. L. Scarf (TRW Defense and Space Systems Group, Redondo Beach, Calif.) Jan. 1981 30 p refs Submitted for publication

(Grants NGL-16-001-002; NGL-16-001-043; Contracts JPL-954013; JPL-954012; N00014-76-C-0016)

(NASA-CR-163966; U-of-Iowa-81-3) Avail: NTIS HC A03/MF A01 CSCL 03B

The Voyager 1 encounter with Saturn provided the first opportunity to investigate plasma wave interactions in the magnetosphere of Saturn. An overview of the principal results from the Voyager 1 plasma wave instrument is presented starting with the initial detection of Saturn and ending about four weeks after closest approach. A survey plot of the electric field intensities detected during the Saturn encounter is shown starting shortly before the inbound shock crossing and ending shortly after the outbound magnetopause crossing. Many intense waves were observed in the vicinity of Saturn. To provide a framework for presenting the observations, the results are discussed more or less according to the sequence in which the data were obtained.

T.M.

N81-18973*# National Aeronautics and Space Administration, Washington, D. C.

MODIFICATION OF THE FLOW PASS METHOD AS APPLIED TO PROBLEMS OF CHEMISTRY OF PLANET ATMOSPHERES

V. A. Parshev Aug. 1980 14 p refs Transl. into ENGLISH of "Modifikatsiya Metoda Potokovoy Progonki Primenitelno k Zadacham Khimii Planetnykh Atmosfer" Rept. Pr-387 Moscow, *1978 12 p Transl. by Kanner (Leo) Associates, Redwood City,* Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow

(Contract NASw-3199)

(NASA-TM-76203) Avail: NTIS HC A02/MF A01 CSCL 03B

It was shown that the modified flow pass method possesses considerable effectiveness, both in the case when the coefficient of diffusion changes severely in the examined region and in the case when diffusion is the prevalent process, as compared with chemical reactions. The case when a regular pass proves inapplicable, or applicable in a limited interval of the decisive parameters, was examined.

T.M.

N81-18974 *Colorado Univ. at Boulder.*

THE CARBON-MONOXIDE FOURTH POSITIVE BANDS IN THE VENUS DAYGLOW Ph.D. Thesis

Samuel Thornton Durrance 1980 134 p

Avail: Univ. Microfilms Order No. 8103090

Spectral observations of the Venus dayglow between 1200 and 1800 A are presented. They were carried out with the Pioneer Venus orbiter ultraviolet spectrometer, a rocketborne telescope and spectrometer and the International Ultraviolet Explorer satellite. The carbon monoxide fourth positive molecular bands are identified in these spectra. Emission rate factors for the fourth positive system are calculated using a high resolution solar flux and the importance of solar emission line excitation to this fluorescence spectrum is shown. The fourth positive band emissions are analyzed and the dominant excitation mechanism is shown to be resonant and fluorescent scattering. The excitation mechanism of the (14,v') bands is shown to be fluorescent scattering of solar Lyman alpha radiation. This identification resolves the problem of the interpretation of the ratio of the OI1304/1356 A emissions from Venus. The unique character of the Lyman-alpha induced v' = 14 fluorescence spectrum is used to measure the CO density below the turbopause. It is shown not to be uniformly mixed in the region from 130 to 115 km.

Dissert. Abstr.

N81-18992#* *Jet Propulsion Lab., California Inst. of Tech., Pasadena.*

THE DSN RADIO SCIENCE SYSTEM

B. J. Buckles *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 89-93 (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-18975 Stevens Inst. of Tech., Hoboken, N. J.

A THEORETICAL MODEL FOR TYPE 2 SOLAR RADIO BURSTS Ph.D. Thesis

Boris Kuharetz 1980 170 p

Avail: Univ. Microfilms Order No. 8100854

Excitation of type 2 radio bursts is taken to occur as the result of electron-electron two stream processes in double layer regions which are formed in the front and at the rear boundary regions of supersonic proton streams. Such streams which move through the solar corona are formed during the annihilation process of magnetic fields in the flash phase of a solar flare. It is shown that the proton stream and double layer structure can form a self-consistent system which is specified by double layer conditions as described in Carlqvist's theory. A BGK approach is used to estimate the double layer length scale L (DL) = approximately 1 meter which corresponds to a double layer potential drop phi (0)volts. Band splitting in type 2 radio bursts is accounted for by the model. The splitting is a consequence of the different values of the coronal plasma frequency at the front and at the rear boundary double layer regions of the proton stream. On the basis of this model an estimate of the type 2 radio brightness temperature (approximately 10 to the 11th power K) is obtained which is in agreement with the observed order-of-magnitude. Dissert. Abstr.

N81-18976*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN ACCURATE METHOD FOR COMPUTING THE ABSORPTION OF SOLAR RADIATION BY WATER VAPOR

Ming-Dah Chou Apr. 1980 35 p refs

(NASA-TM-80254) Avail: NTIS HC A03/MF A01 CSCL 03B

The method is based upon molecular line parameters and makes use of a far wing scaling approximation and k distribution approach previously applied to the computation of the infrared cooling rate due to water vapor. Taking into account the wave number dependence of the incident solar flux, the solar heating rate is computed for the entire water vapor spectrum and for individual absorption bands. The accuracy of the method is tested against line by line calculations. The method introduces a maximum error of 0.06 C/day. The method has the additional advantage over previous methods in that it can be applied to any portion of the spectral region containing the water vapor bands. The integrated absorptances and line intensities computed from the molecular line parameters were compared with laboratory measurements. The comparison reveals that, among the three different sources, absorptance is the largest for the laboratory measurements. T.M.

N81-18977*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

SIMULATION OF THE MAGNETIC STRUCTURE OF THE INNER HELIOSPHERE BY MEANS OF NON-SPHERICAL SOURCE SURFACE

R. H. Levine (Harvard-Smithsonian Center for Astrophysics), M. Schulz, and E. N. Frazier 2 Jan. 1981 59 p

(Contract NAS8-33376)

(NASA-CR-161644; ATR-81(8454)-3) Avail: NTIS HC A04/MF A01 CSCL 03B

A new method for mapping the Sun's magnetic field B from the photosphere through the corona and interplanetary space is presented. The method entails the derivation of B from a scalar potential within a current-free annular volume bounded inside by photosphere and outside by a prescribed nonspherical source surface to which B is made (as nearly as possible) perpendicular. As usual we obtain the potential for the part of B that arises from currents inside the Sun by fitting an expansion to the observed line-of-sight component of B at the photosphere. A second least-squares fit is introduced to obtain the part of B that arises from currents outside the source surface. Comparisons are made between this model and observed coronal and interplanetary structures. There is evidence that observation data underestimate the strength of photospheric polar magnetic fields. S.F.

N81-18978# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

UPSTREAM PARTICLES OBSERVED IN THE EARTH'S FORESHOCK REGION Progress Report, 1977 - 1978

T. E. Eastman, R. R. Anderson, L. A. Frank, and G. K. Parks Jul. 1980 68 p refs Submitted for Publication

(Contract N00014-76-C-0016)

(AD-A094025; U-of-Iowa-80-26) Avail: NTIS HC A04/MF A01 CSCL 03/2

Based primarily on extensive study of fully three dimensional plasma data, we describe the interrelationships of the upstream particles and plasma waves observed in the Earth's foreshock region. The Univ. of Iowa LEPEDEAs detect ions and electrons from 1 eV to 45 keV over all except approx 2% of the unit sphere. Comparisons are made with high time resolution particle data obtained by the Univ. of Calif. (Berkeley) instruments and plasma wave data collected by the Univ. of Iowa plasma wave instruments on the two ISEE spacecraft. The presence of ion beams or dispersed ion distributions is found to be a sufficient condition for the presence of electrostatic and electromagnetic wave emissions. Detailed correlations of ions with plasma waves down to a tenth of an ion gyro-period indicate that ion-acoustic emission is enhanced when increased anisotropies and gyrophase organization are observed. Time aliasing effects limit the interpretation of velocity distributions taken within the foreshock region. High time resolution correlations between the different instruments, however, demonstrate that time variations of a single isotropic or anisotropic distribution cannot produce the dispersed ion distributions. GRA

N81-18979# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.

ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK

Nov. 1980 233 p Prepared for Argonne National Lab., Ill.

(Contract DE-AC01-79CS-30027)

(SOLAR/0010-80/11) Avail: NTIS HC A11/MF A01

Data collected and analyzed in order to determine the thermal performance of selected solar energy systems are presented. The data include: solar insolation, ambient temperature, wind speed, and relative humidity. DOE

N81-18980# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

INSOLATION DATA MANUAL: LONG-TERM MONTHLY AVERAGES OF SOLAR RADIATION, TEMPERATURE, DEGREE-DAYS AND GLOBAL K SUB T FOR 248 NATIONAL WEATHER SERVICE STATIONS

Connie L. Knapp, T. L. Stoffel, and S. D. Whitaker Oct. 1980 294 p refs

(Contract DE-AC02-77CH-00178)

(SERI/SP-755-789) Avail: NTIS HC A13/MF A01

Monthly averaged data is presented which describes the availability of solar radiation at 248 National Weather Service stations. Monthly and annual average daily insolation and temperature values have been computed from a base of 24 to 25 years of data. Average daily maximum, minimum, and monthly temperatures are provided for most locations in both Celsius and Fahrenheit. Heating and cooling degree-days were computed relative to a base of 18.3 (0) C (65(0)F). For each station, global anti K/sub T/ (cloudiness index) were calculated on a monthly and annual basis. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-18981*# Rockwell International Corp., Anaheim, Calif. Electronics Systems Group.

TIROS-N COSMIC RAY STUDY Final Contract Report, Apr. - Sep. 1980

J. T. Blandford, Jr. and J. C. Pickel 10 Sep. 1980 92 p refs

(Contract NAS5-26180)

(NASA-CR-166628; C80-588/201) Avail: NTIS HC A05/MF A01 CSCL 03B

An experimental and analytical study was performed on the impact of galactic cosmic rays on the TIROS-N satellite memory in orbit. Comparisons were made of systems equipped with the Harris HMI-6508 1 x 1024 CMOS/bulk RAM and the RCA CDP-1821 1 x 1024 bit CMOS/SOS RAM. Based upon the

experimental results, estimated bit error rates were determined. These were at least 8.0 bit errors/day for a 300 kilobit memory with the HMI-6508 and .014 bit errors/day with the CDF-1821. It was also estimated that the HMI-6508 latchup rate in orbit is at least two orders of magnitude less than the bit error rates; the CDP-1821 will not latchup. T.M.

N81-18982*# National Aeronautics and Space Administration, Washington, D. C.
RECOGNITION OF BINARY X-RAY SYSTEMS UTILIZING THE DOPPLER EFFECT
B. L. Novak Aug. 1980 19 p refs Transl. into ENGLISH of "Vyyavlenie dvoynykh rentgenovskikh sistem ispol'zovaniem Effekta Dopplera" Rept. PR-361 Moscow, 1977 p 1-15 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academy of Sciences USSR, Moscow
(Contract NASw-3199)
(NASA-TM-76232; PR-361) Avail: NTIS HC A02/MF A01 CSCL 03B

The possibility of recognizing the duality of a single class of X-ray systems utilizing the Doppler effect is studied. The procedure is based on the presence of a period which coincides with the orbital period at the intensity of the radiation in a fixed energy interval of the X-ray component of a binary system. Author

N81-18983# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellen-Ausbreitung.
STUDY OF LOW-ENERGY ELECTRON FLUX AND ITS REACTION TO ACTIVE EXPERIMENTATION ON SPACE-LAB
R. Schmidt, N. Valavanoglou, and W. Riedler Jan. 1979 49 p Partly in GERMAN and ENGLISH
(INW-7904) Avail: NTIS HC A03/MF A01

Results of simulated experiments studying low energy electron flux and its effect on active experimentation onboard Spacelab are reported. Emphasis is placed on the spacecraft environment resulting from combustion processes onboard the Spacecraft, outgassing, odors and toxic fumes partially caused by astronauts' exhaled air. The extensive measurements, precautions, and expenses involved are outlined. Transl. by E.A.K.

99 GENERAL

N81-18984*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION Progress Report, Nov. - Dec. 1980
N. A. Renzetti, ed. 15 Feb. 1981 180 p refs
(Contract NAS7-100)
(NASA-CR-164003; JPL-PR-42-61) Avail: NTIS HC A09/MF A01 CSCL 05A

Progress in the development and operations of the Deep Space Network is reported including developments in Earth based radio technology as applied to other research programs. These programs include application of radio interferometry at microwave frequencies to geodetic measurements and geodynamics, use of deep space stations individually and in pairs as an interferometer by radio astronomers for astrophysics research by direct observations of radio sources, and radio search for extraterrestrial intelligence in the microwave region of the electromagnetic spectrum. For individual titles, see N81-18985 through N81-18998.

N81-18985*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ATMOSPHERIC MEDIA EFFECTS ON ARIES BASELINE DETERMINATION c46
S. C. Wu *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 1-6 ref (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 04A

Different types of media effects on ARIES baseline determination are compared. The effectiveness of simple ionospheric calibration models are studied. To perform the covariance analysis, an ARIES observation sequence needs to be assumed. For the current purposes, the observation sequence is selected to be that of experiment 80D over the JPL/Goldstone baseline (approximately 180 km). This experiment consisted of 96 observations over a period of approximately 25 hours on March 25 to 26, 1980. It is found through covariance analyses that the component most sensitive to media depends heavily upon the correlation, between the two stations, of the media effects. It is also found that relying on the cancellation of ionospheric delays between the two ray paths of VLBI observations at S band results in a large error in baseline length determination. High degree removal of ionospheric effects is possible with a crude model, providing correct diurnal peak and minimum ionospheric levels are input. J.M.S.

N81-18986*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HISTORICAL DATA ON CHARACTERISTICS OF RADIO SYSTEMS USED FOR UNITED STATES DEEP-SPACE COMMUNICATIONS c32
N. F. deGroot and H. R. Bahadori *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 7-16 (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 17B

Historical data on selected communication parameters are presented in tables and charts for 14 deep space missions. Some observations are made about trends in communication capability. Author

N81-18987*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER 10 AND 11 MISSION SUPPORT c14
R. E. Nevarez *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 17-21 ref (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 14B

The current estimate of the Deep Space Network performance capability in tracking the Pioneer 10 and Pioneer 11 spacecraft to the end of their projected life expectancy is given. Author

N81-18988*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT c14
N. Fanelli and H. Nance *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 22-26 (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 14B

Mission support provided by Deep Space Network for Project Voyager is discussed. Mission operations covered include for Voyager 1 the far encounter 2, Saturn near encounter, and the post encounter phase, and for Voyager 2 the Jupiter Saturn cruise phase. J.M.S.

N81-18989*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A BINARY COHERENT OPTICAL RECEIVER FOR THE FREE-SPACE CHANNEL c74
V. A. Vilnrotter *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 27-38 refs (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 20F

The structure of a coherent binary optical MAP receiver was derived and the effects of background radiation and phase estimation errors on receiver performance were evaluated. It was found that random phase errors do not affect the performance of the coherent receiver significantly, as long as the standard deviation of the phase error remains less than roughly 0.14 radians (or 8 degrees). It was also shown that background radiation is effectively suppressed by the optical homodyne receiver: Significant deterioration in receiver performance is observed only in the presence of extremely intense background fields. The most notable characteristic of the binary optical homodyne receiver therefore appears to be its ability to achieve quantum limited performance in high background environments, provided that sufficiently accurate estimates of the received phase can be obtained. J.M.S.

N81-18990*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DEEP SPACE NETWORK SOFTWARE COST ESTIMATION MODEL c61

R. C. Tausworthe *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 39-57 refs (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 09B

A parametric software cost estimation model prepared for Deep Space Network (DSN) Data Systems implementation tasks is presented. The resource estimation model incorporates principles and data from a number of existing models. The model calibrates task magnitude and difficulty, development environment, and software technology effects through prompted responses to a set of approximately 50 questions. Parameters in the model are adjusted to fit DSN software life cycle statistics. The estimation model output scales a standard DSN Work Breakdown Structure skeleton, which is then input into a PERT/CPM system, producing a detailed schedule and resource budget for the project being planned. J.M.S.

N81-18991*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

A SENSITIVITY MODEL FOR ENERGY CONSUMPTION IN BUILDINGS. PART 1: EFFECT OF EXTERIOR ENVIRONMENT c44

F. L. Lansing *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 58-88 refs (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 10A

A simple analytical model is developed for the simulation of seasonal heating and cooling loads of any class of buildings to complement available computerized techniques which make hourly, daily, and monthly calculations. An expression for the annual energy utilization index, which is a common measure of rating buildings having the same functional utilization, is derived to include about 30 parameters for both building interior and exterior environments. The sensitivity of a general class building to either controlled or uncontrolled weather parameters is examined. A hypothetical office type building, located at the Goldstone Space Communication Complex, Goldstone, California, is selected as an example for the numerical sensitivity evaluations. Several expressions of variations in local outside air temperature, pressure, solar radiation, and wind velocity are presented. J.M.S.

N81-18992*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE DSN RADIO SCIENCE SYSTEM c91

B. J. Buckles *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 89-93 (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 03B

The Radio Science experiments at Voyager 1 Saturn encounter which included two atmospheric occultations, a planetary ring occultation, and ring scattering experiment were supported by Deep Space Stations in Australia (DSS 43) and Spain (DSS 63). The DSN Radio Science System data flow from receipt of the radio signals at the antenna to delivery of the recorded data to the project are described. J.M.S.

N81-18993*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CONVERSION OF THE DSN TELETYPE SUBSYSTEM TO THE EIGHT-LEVEL ASCII NATIONAL STANDARD c32

G. J. Brunder *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 95-102 (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 17B

A functional description of the new eight level ASCII Teletype Subsystem and its constitutent Teletype Assemblies is given. An overview of the implementation of the Teletype Subsystem is presented together with a discussion of the distinct capabilities of its equipment. J.M.S.

N81-18994*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

TELEMETRY DEGRADATION DUE TO A CW RFI INDUCED CARRIER TRACKING ERROR FOR THE BLOCK IV RECEIVING SYSTEM WITH MAXIMUM LIKELIHOOD CONVOLUTION DECODING c17

M. K. Sue *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 103-111 refs (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 09F

Models to characterize the behavior of the Deep Space Network (DSN) Receiving System in the presence of a radio frequency interference (RFI) are considered. A simple method to evaluate the telemetry degradation due to the presence of a CW RFI near the carrier frequency for the DSN Block 4 Receiving System using the maximum likelihood convolutional decoding assembly is presented. Analytical and experimental results are given. J.M.S.

N81-18995*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

COMMAND SYSTEM OUTPUT BIT VERIFICATION c32

C. W. Odd and S. F. Abbate *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 112-114 (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 17B

An automatic test was developed to test the ability of the deep space station (DSS) command subsystem and exciter to generate and radiate, from the exciter, the correct idle bit sequence for a given flight project or to store and radiate received command data elements and files without alteration. This test, called the command system output bit verification test, is an extension of the command system performance test (SPT) and can be selected as an SPT option. The test compares the bit stream radiated from the DSS exciter with reference sequences generated by the SPT software program. The command subsystem and exciter are verified when the bit stream and reference sequences are identical. It is a key element of the acceptance testing conducted on the command processor assembly (CPA) operational program (DMC-0584-OP-G) prior to its transfer from development to operations. J.M.S.

N81-18996*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DEVELOPMENT OF A POLYMETRIC GROUT FOR THE HYDROSTATIC BEARING AT DSS 14 c37

C. E. McClung (Monsanto Research Corp.), J. L. Schwendeman (Monsanto Research Corp.), G. L. Ball, III (Monsanto Research Corp.), G. H. Jenkins (Monsanto Research Corp.), R. D. Casperson, G. P. Gale, and A. A. Riewe *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 115-148 ref (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 13I

Results of an investigation into the causes of the deterioration and premature failure of the grout under the hydrostatic bearing runner at DSS 14 are reported. Generic types of materials were screened and tested to find a grout material more resistive to the causes of grout failure. Emphasis was placed on the physical properties, strength, modulus of elasticity, and resistance to erosion and chemical attack by oil and unique requirements imposed by each material for mixing, placing, compacting, and cooling. The polymetric grout developed to replace the dry grout is described. J.M.S.

N81-18997*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

WIND LOADS FOR BAR-TRUSS STRUCTURES c39

M. S. Katow *In its* The Telecommun. and Data Acquisition 15 Feb. 1981 p 149-153 refs (For primary document see N81-18984 09-99)

Avail: NTIS HC A09/MF A01 CSCL 20K

An analysis method developed to calculate the wind loads on the nodes or joints of the truss type support structure of the 64 meter antenna is described. The method uses the CBAR element and GRID coordinate cards of the NASTRAN or IDEAS structural analysis programs as inputs to the computer model of the structure. Cross flow principles and vector analysis are also used in the analysis. The algorithms used are described and probable accuracy of the solution is discussed. J.M.S.

N81-18998*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

FUEL CELLS FEASIBILITY c44

D. Schonfeld and T. Charng *In its* The Telecommun. and Data

Acquisition 15 Feb. 1981 p 154-168 refs (For primary document see N81-18984 09-99)
Avail: NTIS HC A09/MF A01 CSCL 10A

The technical and economic status of fuel cells is assessed with emphasis on their potential benefits to the Deep Space Network. The fuel cell, what it is, how it operates, and what its outputs are, is reviewed. Major technical problems of the fuel cell and its components are highlighted. Due to these problems and economic considerations it is concluded that fuel cells will not become commercially viable until the early 1990s. J.M.S.

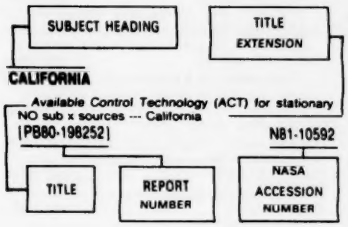
N81-18999# *Office of the Deputy Secretary of Defense, Washington, D. C.*

REQUIRED IN-HOUSE CAPABILITIES FOR DEPARTMENT OF DEFENSE RESEARCH, DEVELOPMENT, TEST AND EVALUATION

1 Oct. 1980 26 p refs
(AD-A094024) Avail: NTIS HC A03/MF A01 CSCL 05/1

This report describes the required in-house RDT and E capabilities of the Department of Defense (DOD) RDT and E organizations. It discusses the role of Government R and D, the R and D process and environment, DOD responsibilities, and finally the required in-house capabilities. This document discusses the responsibilities of the DOD internal research, development, test and evaluation establishment, which comprises program management offices, laboratories, research and development centers, test and evaluation activities, and other technical organizations. Collectively, these internal RDT and E organizations represent a vital component of the Defense research, development, and acquisition program. GRA

Typical Subject Index Listing



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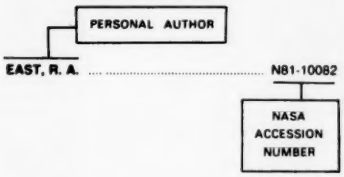

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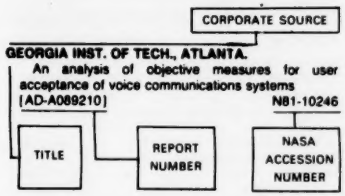

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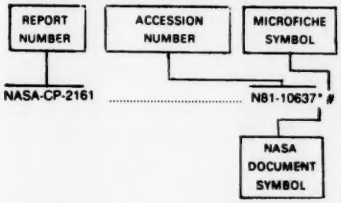

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